

THE MANAGEMENT OF HUMAN FACTORS IN FAA ACQUISITION PROGRAMS

Final Report

Submitted by
The Reconstituted STARS Human Factors Steering Committee
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EXECUTIVE SUMMARY

Background

The STARS Human Factors Issues Steering Committee chartered the STARS Human Factors Process Group in November 1997. The Human Factors Process Group completed their initial product describing an interim process for resolving STARS human factors issues on December 8, 1997. The group was reconstituted in mid-January 1998 as the Human Factors Process Group. This report documents the work of the Human Factors Process Group on a generalized process to manage human factors and user involvement issues throughout the acquisition lifecycle. The Reconstituted STARS Human Factors Steering Committee has reviewed and approved this report with minor revisions to clarify responsibilities for the continued development of FAA human factors guidelines and conventions.

The Human Factors Process Group was composed of members selected by the Steering Committee to represent both their organizations and technical expertise. The Human Factors Process Group included representatives from: Air Traffic Services (ATS), Office of Research and Acquisitions (ARA), the National Air Traffic Controller Association (NATCA), Professional Airways Systems Specialists (PASS), National Association of Air Traffic Specialists (NAATS), and The MITRE Corporation's Center for Advanced Aviation System Development (MITRE/CAASD).

Human Factors Process Group Major Findings

The Human Factors Process Group's evaluation of the Acquisition Management System (AMS), the Integrated Product Development System (IPDS), and the execution of these systems for STARS and other existing acquisition programs revealed a number of problems related to FAA's management of human factors. The Human Factors Process Group summarized these problems in terms of the following six major findings.

1. The FAA lacks an overall human factors management structure and process to coordinate human factors resources/programs within the FAA.
2. There is a lack of adequate human factors analyses and user involvement during the Mission Analysis (MA) and Investment Analysis (IA) phases of the acquisition lifecycle.
3. Human factors considerations are given little weight in Product Team (PT)/Integrated Product Team (IPT) decisions during the solution implementation phase of the acquisition lifecycle.
4. Human factors issues and user concerns are often not communicated to high-level decision makers (e.g., managers on the Integrated Product Leadership Team (IPLT) or Joint Resources Council (JRC)).
5. There is currently no formal mechanism for union involvement within the AMS.

6. There is inadequate coordination, planning, and management of resources for human factors in the acquisition lifecycle.

It is important to note that the problems identified by the Human Factors Process Group are highly interdependent and often interact to affect acquisition programs

Human Factors Process Group Recommendations

As the Human Factors Process Group completed its review of the AMS and IPDS, they identified a number of potential solutions to the problems identified at each stage in the acquisition lifecycle. These potential solutions were then grouped into five major recommendations designed to solve user involvement, union involvement and human factors management problems associated with FAA acquisition programs. These recommendations include:

1. Designate the Office of Chief Scientist for Human Factors as the lead FAA human factors organization with responsibility and accountability to work in partnership with and support MA teams, IA teams, and IPTs for human factors policy development, planning, and execution.
2. Amend AMS policy and/or guidance to clarify roles and responsibilities for human factors activities in all phases of the acquisition lifecycle.
3. Establish Technical Liaison positions within the NATCA, PASS, and NAATS organizations to provide union involvement at designated points in the acquisition lifecycle.
4. Establish a mechanism and implementation plan to allocate and manage resourcing of human factors activities in all phases of the acquisition lifecycle.
5. Establish a mechanism and implementation plan to ensure that the Human Factors Process Group recommendations are acted upon in a timely manner.

The above recommendations are components of an integrated approach to the resolution of the six problem areas described in the previous section. It is important to underscore the fact that the recommendations were designed to be implemented as a “package” to solve the highly dependent problems identified by the Human Factors Process Group

Next Steps

The next steps in implementing the recommendations include:

- Briefing the FAA Administrator, relevant Associate Administrators, and Union Presidents;
- Reaching agreement on recommendations to be implemented;
- Completing detailed implementation planning; and
- Executing the implementation plan and enabling management actions.

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INTRODUCTION

Background

The STARS Human Factors Steering Committee chartered the STARS Human Factors Process Group in November 1997. The STARS Human Factors Process Group was tasked by the Steering Committee to develop two products:

- A process to be applied specifically to the resolution of human factors issues related to STARS (due December 15, 1997); and
- A more generalized process to manage human factors, union involvement and user involvement issues throughout all phases of system acquisition programs (due January 26, 1998).

The Human Factors Process Group completed their initial product describing an interim process for resolving STARS human factors issues on December 8, 1997. The group was reconstituted in mid-January 1998 to develop the second product. The new group was designated as the Human Factors Process Group to clarify its focus on human factors in the overall acquisition process.

This report documents the work of the Human Factors Process Group on a generalized process to manage human factors, union involvement and user involvement issues throughout the acquisition lifecycle. This report finalizes the findings and recommendations presented in a preliminary executive report delivered to the STARS Human Factors Steering Committee on January 26, 1998.

The Reconstituted STARS Human Factors Steering Committee reviewed this report and made minor revisions to Recommendations 1 and 2. These revisions were made to clarify the responsibilities for continued development and regular updating of human factors guidelines and conventions to be applied in FAA acquisition programs. On March 27, 1998, the Steering Committee approved this report and concurred with an AAR-100 recommendation to begin implementation planning for the new human factors management process.

Human Factors Process Group Purpose and Approach

The Human Factors Process Group convened on January 14, 1998, to begin work on a long-term solution to avoid the occurrence of human factors problems in future acquisition programs.

The group was composed of members selected by the Steering Committee to represent both their organizations and technical expertise. The group members and their organizations are presented in Appendix A. The Human Factors Process Group that developed this product included representatives from:

- Air Traffic Service (AAT);
- National Air Traffic Controller Association (NATCA);

- Airway Facilities Service (AAF);
- Professional Airways Systems Specialists (PASS);
- National Association of Air Traffic Specialists (NAATS);
- Office of the Chief Scientist for Human Factors (AAR-100);
- Office of Air Traffic Systems Development (AUA);
- Office of Communication, Navigation, and Surveillance Systems (AND);
- Air Traffic Requirements Service (ARS);
- William J. Hughes Technical Center (ACT); and
- MITRE/CAASD.

The Human Factors Process Group, which met from January 14, 1998, through January 23, 1998, used a modified consensus decision process (defined in Appendix B) during the development of its recommendations.

During the initial Human Factors Process Group meetings in December 1997, the group concluded that the primary human factors problems associated with the STARS program resulted from poor execution of existing processes, rather than from major flaws in the acquisition process itself. The first step to be completed when the Human Factors Process Group convened in January 1998 was to examine the existing Acquisition Management System (AMS) and Integrated Product Development System (IPDS) policies to determine whether or not they provided an adequate framework within which to operate.

After reviewing the AMS and IPDS, the Human Factors Process Group determined that its goal should be to make the acquisition system more responsive to human factors considerations. This goal was to be accomplished by:

- Examining problems associated with user involvement and the integration of human factors in each phase of the acquisition lifecycle as defined by the AMS;
- Identifying human factors activities and user involvement required in each phase of the acquisition lifecycle;
- Determining roles and responsibilities associated with effective management of user involvement and human factors considerations;
- Identifying the management process and structure required to improve accountability for execution of required human factors activities;
- Examining funding issues associated with user involvement and human factors integration; and
- Defining the role of union involvement in human factors activities and in the acquisition process.

Acquisition Management System

The findings and recommendations of the Human Factors Process Group are designed to be applied within the context of the FAA's AMS and, more specifically, in the acquisition of systems

and software. The Human Factors Process Group recognized that the recommendations must be adapted to fit the somewhat unique aspects of facility acquisition programs. The Human Factors Process Group did not intend to apply its recommendations to the acquisition of services or support contracts.

The AMS is graphically represented in Figure 1. It consists of several phases and sub-phases parsed by decision points.

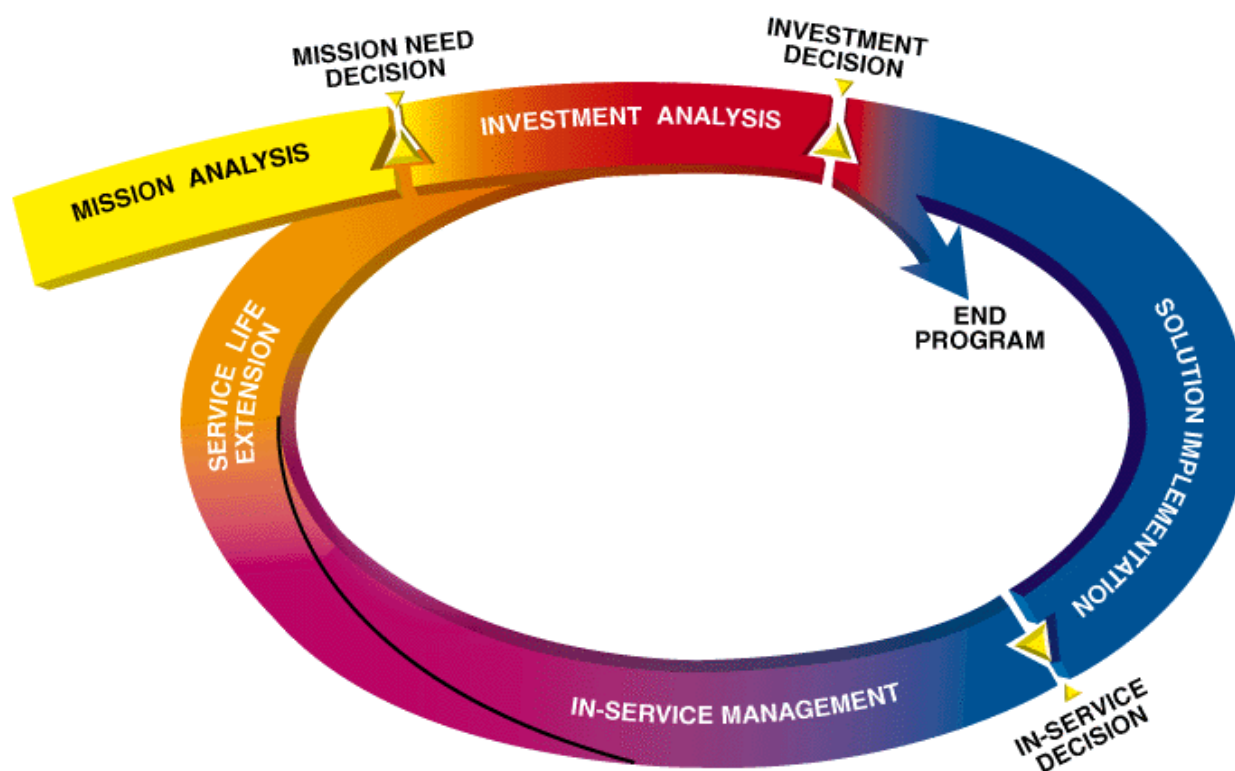


Figure 1: The AMS Model

Mission Analysis Phase. The first phase of the acquisition lifecycle is Mission Analysis (MA), in which either mission capability shortfalls or technology opportunities are identified and validated. This is intended to be a continuous, forward-looking activity performed by each Line of Business (LOBs)¹ for areas related to its mission. The principal product of the MA phase is a Mission Need Statement (MNS) that must clearly describe either the capability shortfall and the impact of not satisfying the shortfall, or the technological opportunity and the increase in operational safety, security, efficiency, or effectiveness that it will achieve. The MNS must also assess the criticality

¹ LOBs are the seven major operational organizations in the FAA headed by Associate Administrators. These are: Air Traffic Services (ATS), Research and Acquisition (ARA), Regulation and Certification (AVR), Civil Aviation Security (ACS), Airports (ARP), Administration (AAD), and Commercial Space Transportation (AST)

and timeframe of the need, and roughly estimate the resources the agency should commit to resolving it based on its worth, criticality, and the scope of likely changes to the agency's asset base.

The MNS is developed by an interdisciplinary MA team, led by the LOB that has identified the capability shortfall or technology opportunity. The source and rationale of funding of the MA team is not always clearly specified. The initial identification of a capability shortfall or technology opportunity may evolve out of operational issues or situations (paid for by OPS funds), out of another acquisition program (paid for by F&E funds) or from research engineering and development efforts (paid for by R,E&D funds). The decision at the end of the MA phase is whether or not there is a significant mission need which warrants investigation. The Joint Resources Council (JRC) is responsible for making this decision. For this decision, the JRC is chaired by the LOB leading the MA.

Human factors considerations may apply to the MA phase in three ways. First, specific human factors capability shortfalls might be identified for analysis. Second, specific technological opportunities related to human factors may be identified for analysis. Third, and most likely, is that a capability shortfall or technological opportunity poses a change or challenge to the Agency's human asset base that requires human factors analysis to develop a complete MNS. The MNS must include human resource and performance considerations. A variety of human factors analyses, including modeling and simulation, are useful in the MA phase.

The basic issue is how an identified mission need might result in a change to the human factors baseline. For example, if the communication of weather information from ground to air is identified as a capability shortfall, this need should be examined against the current communication methods, technologies and workload for potential impacts. Similarly, some technology opportunities appear to provide significant reductions in human workload, but these claims must be examined for their logic, empirical validity, and implications for the Agency's human asset base. The human factors activities undertaken in the MA phase will provide important information to be considered during the comparison of alternatives in the Investment Analysis phase. Many engineers and operational personnel are unaware of the extent to which useful modeling and simulation of changes in the human factors baseline can be conducted in the MA phase.

Investment Analysis Phase. The second phase of the acquisition lifecycle is Investment Analysis (IA) in which alternative solutions are identified and compared for value and risk in meeting the need documented in a MNS. To accomplish this, top-level performance and supportability requirements must be specified. Market analysis, alternatives analysis and affordability analysis must be conducted to determine the best solution. The decision at the conclusion of the IA phase is the Investment Decision which generally initiates a program with funding and a schedule (called the Acquisition Program Baseline-APB).

In addition to the APB, the IA phase produces the Requirements Document (RD) and the Investment Analysis Report. The APB is critical because it elaborates on the program schedule and funding plan. If adequate funds or time for necessary activities (such as human factors

activities) are not planned in the APB, it is very difficult to add them later. The IA phase and IA team are jointly led by the sponsoring LOB and the acquisition organization. The funding for the analyses in the IA phase (including the human factors activities) is not always clear. It is often a combination of OPS, F&E and R,E&D funds. The JRC, chaired by the Acquisition Executive, makes the investment decision while the Acquisition Executive and Associate Administrator of the sponsoring LOB must approve the proposed APB.

Human factors activities should play a critical role in the IA phase (including human performance modeling and simulation). A benefit of identifying a commercial or non-developmental alternative to meet a mission need is the potential for reduced cost and time requirements. It cannot be assumed, however, that COTS/NDI solutions have had adequate human factors consideration. Human factors analyses of these potential solutions can help determine the frequently hidden costs and schedule issues that arise in applying a commercial or non-developmental solution in the FAA environment and human asset base. Human factors activities can help to distinguish and differentiate between proposed alternatives, particularly on operability and supportability factors. Human resource costs represent the largest cost in most systems lifecycles. Human factors activities can provide the necessary information to accurately compare alternative solutions. By the conclusion of the IA phase, detailed considerations of human-system interfaces and human performance requirements characteristics and criteria must be developed and included in the RD.

Solution Implementation Phase. The third phase of the AMS is Solution Implementation (SI) in which the program acquires the system or software solution and ensures that it will meet the user requirements, be operationally suitable, and be compatible with other operational systems. The decision at the end of the SI phase is the In-Service Decision, which allows deployment activities to begin.

The SI phase is led by the Integrated Product Team (IPT) or Product Team (PT) that is assigned to implement the solution by the JRC at the end of the IA phase. Funding for the activities in the SI phase is mostly F&E and is determined in the APB. The PT primarily reports to the JRC through the IPDS structure; however, individual members of the PT will report back to their functional organization regarding their special areas of expertise and issues (e.g., contracting, legal, etc.).

There are many human factors activities that should be conducted during the SI phase to support the In-Service Decision. These activities include modeling and simulation of components and the full system. Some of these human factors activities can be performed without human subjects, while many require the human to be “in-the-loop” to make assessments. Human factors activities will be necessary to determine the changes in tasks, information, knowledge, skills, and other abilities required of the humans who will operate and maintain new systems or software. This has the potential to drastically reduce late changes in systems prior to deployment. This has major implications for procedures, training and selection activities.

In-Service Management Phase. The fourth and final phase is In-Service Management during which the system is operated, maintained (and often upgraded) and the recurring decision is made whether to extend the life of the system (Service Life Extension) or dispose of the system. During

this period latent defects are removed, improvements are made, performance is monitored, and in-service investment decisions are made to correct newly identified capability shortfalls. In addition, technology opportunities to enhance fielded capabilities and reduce costs are sought. It is intended that this phase will allow for evolutionary product development and rapid insertion of new technology rather than the more traditional wholesale replacement of fielded products.

This phase is a partnership between the LOB that operates and maintains the system and the PT responsible for that system. OPS is the source of funding for most activities in this phase; however, some pre-planned improvements and component upgrades may use F&E funds. When projected that the system may no longer be able to meet service demand or another solution offers potential for improving safety, cost savings, or effectiveness, the LOB or IPT should initiate a new MA and IA so that a new investment decision can be made by the JRC. The decision may be to upgrade the old system, replace the old system or field a new solution.

Human factors must continue to play a key role during the In-Service Management phase. It is a fallacy to believe that all human factors issues can be identified prior to deployment. Although the goal is to identify human factors issues as soon as possible, there are typically human factors issues that are only identified after the system is in use. Therefore, there must be plans and resources for addressing product improvement during deployment, training, and while the system is in-service. Unfortunately, experience has shown that more often human factors issues are handled through additional training and field “work arounds” that become permanent fixes because of inadequate plans to correct the original issues. The PT responsibility for the operability and supportability of its products during the In-Service Management phase includes the capability to assist the operational LOB in solving human factors problems with the product.

Integrated Product Development System

The IPDS is a method of organizing people and resources to support systems or software throughout their lifecycle. As illustrated in Figure 2, the IPDS is based on teams collaborating and cooperating with other teams. The lowest level team is a PT that is responsible for a product (a system or set of systems) throughout its lifecycle. The IPT is one level higher in the IPDS structure. IPTs usually contain several PTs with related products. The Integrated Management Team (IMT), the next level in the IPDS structure, is responsible for integrating several IPTs in a large mission area (e.g., the three existing IMTs are: Communications, Navigation and Surveillance; Air Traffic Systems; and Information Technology). The highest-level team in the IPDS system is the Integrated Product Leadership Team (IPLT), which oversees the IMTs and has membership by all of the major functional organizations that supply personnel and expertise to the PTs and IPTs. The IPLT membership includes key Office and Service level Directors in each of the Lines of Business as well as representation from the Assistant Administrators and the Chief Counsel.

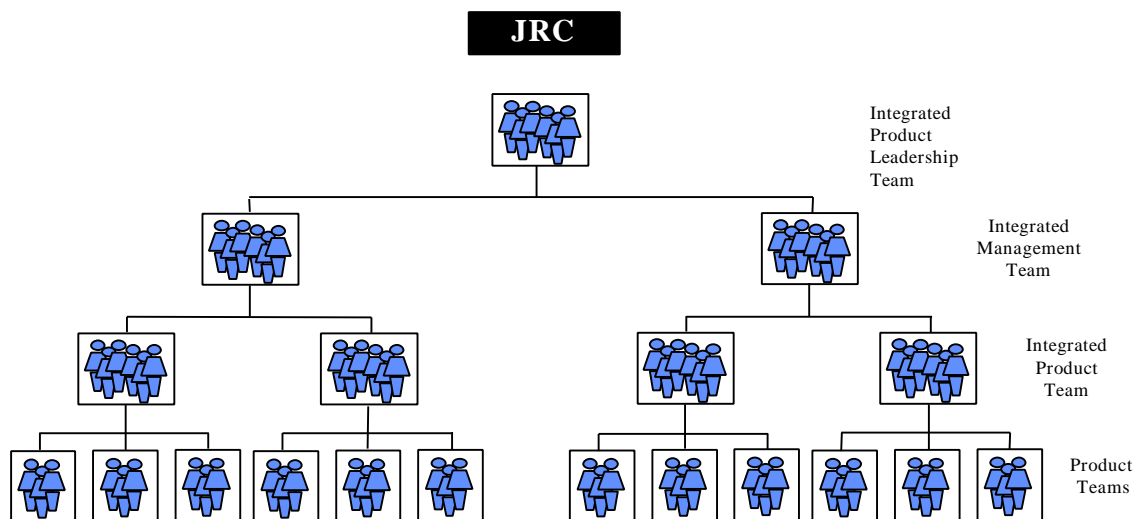


Figure 2: The IPDS Model

Definition of Terms

Before presenting the findings and recommendations, it is important to clarify the distinctions among three terms: *human factors*, *user involvement*, and *union involvement* as defined and used by the Human Factors Process Group.

Human factors is defined as a multidisciplinary effort to generate and compile information about human capabilities and limitations and apply that information to: equipment, systems, software, facilities, procedures, jobs, environments, training, staffing, and personnel management.

User involvement is defined as individuals acting as subject matter experts to provide information for human factors activities. These individuals are expected to be representative of the actual system users (i.e., air traffic controllers, system specialists, supervisors, pilots, etc.). Usually the participation of several individuals would be necessary to provide valid statistical representation of the user community and to accommodate the range of individual differences in the user community.

Union involvement is defined as an individual or individuals whose input reflects the “organizational position” of the collective bargaining unit.

The distinction between user and union involvement is important because user involvement is necessary to conduct scientific human factors activities. Union involvement is necessary to assist in identifying issues related to user acceptance of new systems or software which may interact with or impact human factors issues identified through human factors activities.

HUMAN FACTORS PROCESS GROUP MAJOR FINDINGS

The Human Factors Process Group's evaluation of the AMS, the IPDS, and the execution of these systems for STARS and other existing acquisition programs revealed a number of problems related to FAA's management of human factors. The Human Factors Process Group summarized these problems in terms of the following six major findings.

1. The FAA lacks an overall human factors management structure and process to coordinate human factors resources/programs within the FAA.
2. There is a lack of adequate human factors analyses and user involvement during the MA and IA phases of the acquisition lifecycle.
3. Human factors considerations are given little weight in Product Team (PT)/ Integrated Product Team (IPT) decisions during the SI phase of the acquisition lifecycle.
4. Human factors issues and user concerns are often not communicated to high-level decision makers (e.g., managers on the IPLT or JRC).
5. There is currently no formal mechanism for union involvement within the AMS.
6. There is inadequate coordination, planning, and management of resources for human factors in the acquisition lifecycle.

It is important to note that the problems identified by the Human Factors Process Group are highly interdependent and often interact to affect acquisition programs. For example, the lack of adequate human factors analyses during the MA and IA phases of the acquisition lifecycle is likely to increase the chances that an IPT has inadequate budget or schedule to conduct required human factors analyses during the SI phase, which is further exacerbated by the lack of sufficient numbers of qualified human factors personnel within the FAA. The interdependencies between the FAA's human factors and user involvement problems dictate an integrated approach to their resolution. The Human Factors Process Group's six major findings are described briefly in the paragraphs below.

Finding 1: The FAA lacks an overall human factors management structure and process to coordinate human factors resources/programs within the FAA.

One of the most significant conclusions of the Human Factors Process Group is that the FAA lacks the comprehensive human factors management structure and process needed to coordinate FAA's human factors resources and apply them effectively and efficiently across the acquisition lifecycle. While the FAA has disjointed pockets of human factors expertise and resources within the Associate Administrator for Research and Acquisition (ARA), Associate Administrator for Air Traffic Services (ATS), and Associate Administrator for Regulation and Certification (AVR), no organization is responsible or accountable for the overall coordination of these resources. There are several contributing factors and/or consequences related to this finding:

- Within the AMS, the responsibilities for human factors activities and quality assurance of human factors products are not clearly specified across all phases of the acquisition lifecycle.
- The lack of coordination and role ambiguity has resulted in an under utilization of those human factors resources, tools and information that are currently available.
- The lack of a clearly articulated management structure combined with ambiguity in human factors roles and responsibilities results in insufficient accountability for (and lack of authority to solve) the human factors problems identified in this and other Human Factors Process Group findings.

Finding 2: There is a lack of adequate human factors analyses and user involvement during the MA and IA phases of the acquisition lifecycle.

Many of the human factors problems associated with current acquisition programs in the SI phase can be traced to inadequate identification and management of human factors issues in the MA and IA phases of the acquisition lifecycle. The Human Factors Process Group's evaluation indicates that minimal human factors analysis or structured involvement of operational users occurs in the MA and IA phases of the acquisition lifecycle. There are a number of factors contributing to this problem:

- The AMS policy document is silent regarding human factors in the MA phase and guidance documents do not clearly identify roles and responsibilities for human factors in the IA phase.
- Insufficient funding is provided to conduct appropriate human factors analyses should an organization recognize the need or take the initiative to conduct such work.
- The pressure on the FAA to accelerate modernization of the National Airspace System (NAS) contributes to a general resistance to take the time necessary to conduct human factors analyses, even if the funds were available.
- There is a general sense that requirements identified in the MA and IA phases of the acquisition lifecycle are at too high a level to address human factors issues. Yet, waiting until the SI phase to consider human factors creates a situation in which the resolution of human factors issues is viewed as too costly in terms of impacts on the acquisition program baseline cost and schedule.
- Many of the personnel involved in these early phases of the acquisition lifecycle lack an awareness of the need to conduct human factors analyses and/or are unaware of the capability and benefits of using human factors prototyping, simulation, and modeling in the early phases of the requirements definition process.
- There is a mistaken belief that the FAA's focus on Commercial Off the Shelf/ Non-Developmental Item (COTS/NDI) solutions reduces or eliminates the need to consider human factors issues during the development of Mission Need Statements (MNS) or the investment analysis process.

Finding 3: Human factors considerations are given little weight in Product Team (PT)/ Integrated Product Team (IPT) decisions during the SI phase of the acquisition lifecycle.

The process team concluded that the execution of appropriate human factors activities in the SI phase of the acquisition lifecycle is often severely hampered by the failure in earlier acquisition phases to identify and/or plan for the management of human factors in an acquisition program. Typically, the Acquisition Program Baseline (APB) provided to the IPT does not include cost and schedule components that accommodate necessary human factors prototyping, modeling, simulation, or operability assessments. There are a number of additional factors that lead to a discounting of the importance of human factors activities and/or human factors issues in the tradeoff decisions made at the PT/IPT level during the SI phase:

- The limited availability of internal FAA human factors expertise/personnel in the PTs/IPTs negatively affects consideration of human factors issues because most PT members lack appropriate awareness of their importance and internal resources are not available to provide expert assistance.
- The emphasis on maintaining the program schedule and resource constraints (resulting in funding below the original APB) reduces incentives for IPTs to conduct adequate human factors analyses needed to identify critical issues.
- Qualified human factors experts are seldom members of the PT/IPT core teams that make most program decisions, nor are there human factors experts present at the IMT or IPLT levels in the IPDS.
- Human factors experts may be unable to communicate the potential risks/ consequences of inadequate attention to human factors in terms that can be appreciated by the PT members for inclusion in their tradeoff decisions. This often results from the lack of human factors data needed to translate these risks into quantitative cost/ schedule/ performance impacts on the program.
- The delay in identification of critical human factors issues makes it too late to solve these issues without major cost or schedule impacts – often major human factor problems are not identified until Operational Test and Evaluation (OT&E) activities, which typically occur near the end of the SI phase.

Finding 4: Human factors issues and user concerns are often not communicated to high-level decision makers (e.g., managers on the IPLT or JRC).

The Human Factors Process Group's evaluation indicated that human factors issues and user concerns are often not communicated to high-level decision makers until they have become major problems. Often, an earlier awareness of potential human factors/ user acceptance problems would have allowed senior decision makers to take actions that would ultimately cost less, have fewer schedule impacts, or result in a system with superior performance/ capabilities. The lack of communication on human factors issues is not limited to system-specific problems. There is also a lack of visibility for human factors issues that cut across acquisition programs, or that affect

human factors programs outside the acquisition arena or that concern system integration and interoperability. There are a number of factors that contribute to the lack of communication of human factors issues and user concerns:

- While the FAA Acquisition Executive receives monthly reports on metrics related to program performance, there are no status indicators included that provide insight into the adequacy of human factors integration into the programs.
- The existing decision making process in the PTs/IPTs, combined with the factors noted in Finding 3, effectively filter out human factors issues from information provided to higher levels within the IPDS.
- The multiple layers of management through which information flows in ATS and ARA act as a filter for user concerns. This reflects FAA cultural barriers related to a reluctance to pass bad news up the management chain and the bias to regard human factors issues as minor.
- The lack of data to document human factors concerns also inhibits the reporting of potential issues.
- There is no high-level human factors expert in the role of decision maker in the existing AMS management groups (i.e. IPLT or JRC).

Finding 5: There is currently no formal mechanism for union involvement within the AMS.

The Human Factors Process Group thoroughly considered the issue of union involvement. While there were instances cited in which unions were adequately involved in isolated projects, these occasions were the exception rather than the rule. Furthermore, union inclusion in these projects was dependent on the personalities and experiences of the individuals involved in the project. The lack of a formal mechanism for union involvement in the AMS has clearly resulted in minimal union involvement throughout the acquisition lifecycle. Furthermore, the failure to distinguish between union involvement and user involvement can lead to confusion regarding the information provided by individual union members serving as subject matter experts in human factors evaluations. The Human Factors Process Group considers the issues associated with union involvement as one of the most serious problems identified in their evaluation. This finding is associated with a number of problems that directly or indirectly affect the success of FAA acquisition programs:

- The lack of union involvement typically results in a lack of accurate or timely communication between the unions and the FAA on essential human performance issues. This lack of communication leads to FAA and/or union actions based on partial and sometimes distorted information.
- The lack of accurate and timely communication is one factor undermining trust that creates a situation in which it can be difficult to obtain objective user involvement necessary for human factors studies. This lack of trust can impede the success of

human factors professionals who need to work closely with operational users in both the design and execution of human factors evaluations.

- The lack of a formal mechanism to routinely obtain the “union’s position” on issues throughout the acquisition lifecycle can result in confusion when the opinions of individual union members serving as subject matter experts are interpreted by FAA personnel as representing “official” union positions on issues related to system design or system acceptability

The combination of the above factors negatively influences user acceptance of systems, which may ultimately affect programs’ cost and schedule.

Finding 6: There is inadequate coordination, planning, and management of resources for human factors in the acquisition lifecycle.

The final finding of the Human Factors Process Group is related to the resourcing of human factors efforts affecting all phases of the acquisition lifecycle. FAA’s human factors efforts have severe resource problems related to both funding and internal personnel. Without solutions to these resource problems, attempts to solve other problems cited in the first five findings will be largely ineffective. The specific problems associated with this finding are listed below:

- There are no Facilities and Equipment (F&E) funds allocated to human factors efforts in the acquisition phases prior to the JRC investment decision. The lack of F&E funding is a major constraint limiting validated human factors input needed to support investment analyses that would result in adequate human factors considerations in the APBs provided to IPTs.
- The approval mechanisms that are used to establish priorities for funding Research, Engineering and Development (R,E&D) human factors projects differ from those related to the mission analysis and investment analysis processes. These distinct prioritization mechanisms result in human factors research programs that do not complement or support the needs of acquisition programs or provide essential human factors data useful in the MA or IA phases of the acquisition lifecycle.
- The pressure on the Operations (OPS) budget and continued fiscal constraints at the facility level restrict opportunities for operational user involvement because of the costs associated with travel and backfill overtime.
- There are a limited number of qualified human factors personnel within the FAA. This problem is exacerbated by the lack of an effective human factors management structure that would maximize the utilization of the available talent. The limited number of internal personnel with human factors qualifications also limits the FAA’s ability to provide adequate technical direction to contractor resources working on human factors issues.
- There is a pervasive lack of understanding of the procedural and operational considerations related to obtaining user involvement from the field. This lack of

understanding, combined with insufficient advanced planning and schedule changes, impedes access to operational users for human factors activities. Sudden changes in schedules for human factors activities involving field users may also result in wasting time and money.

HUMAN FACTORS PROCESS GROUP RECOMMENDATIONS

As the Human Factors Process Group completed its review of the AMS and IPDS, they identified a number of potential solutions to the problems identified at each stage in the acquisition lifecycle. These potential solutions were then grouped into five major recommendations designed to solve the user involvement and human factors management problems. The recommendations are:

1. Designate the Office of Chief Scientist for Human Factors as the lead FAA human factors organization with responsibility and accountability to work in partnership with and support MA teams, IA teams, and IPTs for human factors policy development, planning, and execution.
2. Amend AMS policy and/or guidance to clarify roles and responsibilities for human factors activities in all phases of the acquisition lifecycle.
3. Establish Technical Liaison positions within the NATCA, PASS, and NAATS organizations to provide union involvement at designated points in the acquisition lifecycle.
4. Establish mechanisms to allocate and manage resourcing of human factors activities in all phases of the acquisition lifecycle.
5. Establish a mechanism and implementation plan to ensure that the Human Factors Process Group recommendations are acted upon in a timely manner.

The above recommendations, taken together, comprise an integrated approach to the resolution of the six problem areas described in the previous section. It is important to underscore the fact that the recommendations were designed to be implemented as a “package” to solve the highly interdependent problems identified by the Human Factors Process Group. Partial implementation of this set of recommendations will likely result in failure to improve the existing human factors and user involvement problems. The five general recommendations are described briefly in the paragraphs below.

Recommendation 1: Designate the Office of Chief Scientist for Human Factors as the lead FAA human factors organization with responsibility and accountability to work in partnership with and support MA teams, IA teams, and IPTs for human factors policy development, planning, and execution.

Objective:

The primary objective of the recommendation to designate the Office of the Chief Scientist for Human Factors as the lead human factors organization within the FAA is to establish a clear point of responsibility and accountability for the application of human factors related to FAA acquisition programs. The establishment of this lead human factors organization is essential to the implementation of the remainder of the Human Factors Process Group’s recommendations.

Problems Addressed:

The principal problems addressed by this recommendation are those related to the lack of accountability and lack of clarity in roles and responsibilities associated with policy development, planning and execution of human factors activities throughout the acquisition lifecycle. Designating the Office of Chief Scientist for Human Factors as the lead FAA human factors organization is expected to directly affect the resolution of problems associated with:

- Finding 1: The lack of an overall human factors management structure and process to coordinate human factors resources/programs within the FAA.
- Finding 2: The lack of adequate human factors analyses and user involvement during the MA and IA phases of the acquisition lifecycle.
- Finding 3: Human factors considerations are given little weight in PT/ IPT decisions during the SI phase of the acquisition lifecycle.
- Finding 4: Human factors issues and user concerns are often not communicated to high-level decision makers (e.g., managers on the IPLT or JRC).

Key Components of Recommendation:

There are several components related to the Human Factors Process Group's recommendation to designate the Office of Chief Scientist for Human Factors as the lead FAA human factors organization. The unifying theme is that this organization is accountable for providing leadership within the human factors area. To be successful, this organization must work in partnership with other organizations while it supports development of human factors policy and guidance, human factors planning, and implementation of human factors solutions. Successful resolution of the problems identified by the Human Factors Process Group cannot be achieved if the Office of Chief Scientist for Human Factors provides only human factors oversight. The human factors leadership role includes the responsibility to inform senior FAA management when human factors issues are not being adequately addressed in acquisition programs or in other areas that may result in risks to safety or effective and efficient system performance. In accordance with its human factors leadership role, the Office of Chief Scientist for Human Factors will:

- Provide qualified human factors personnel to serve as core team members for IPTs/PTs. These members will function as fully empowered team members within the IPDS framework with their direct functional reporting back to the Office of Chief Scientist. As the functional organization with responsibility for these IPT/PT team members, the Office of Chief Scientist is responsible for establishing qualifications standards, training, and leading the assessment of the technical performance of these human factors professionals.
- Continue the development and regularly update human factors guidelines and conventions to be applied in FAA acquisition programs.
- Ensure that human factors considerations are addressed throughout the acquisition lifecycle. This responsibility encompasses: 1) the requirement to provide support in early acquisition phases to mission analysis and investment analysis teams, and 2) the

requirement to perform quality assurance functions related to assessing the adequacy of the integration of human factors considerations in the products developed throughout the various phases of the AMS (e.g. MNS, Investment Analysis Report, Final Requirements Document, etc.). It is the responsibility of this office to identify deficiencies in the FAA's integration of human factors activities throughout the acquisition lifecycle and initiate corrective actions required to resolve these problems.

- Serve as a member of the IMTs and IPLT. As a member of these IPDS management teams, representatives from the Office of Chief Scientist will focus on cross-cutting human factors issues outside the boundaries of the PTs/IPTs but will also work with other functional organization managers to resolve human factors deficiencies that are not or cannot be addressed adequately within the PTs/IPTs.
- Develop indices and mechanisms that track human factors to ensure that senior managers within ARA, ATS, and members of the JRC are fully informed on critical human factors issues. These issues may relate to specific acquisition programs or overall management of human factors issues within the FAA.

Implementation Issues:

The Human Factors Process Group recognizes that the Office of Chief Scientist currently is not adequately resourced to assume the responsibilities associated with this recommendation. One of the most critical implementation activities associated with the recommendations contained in this report is identifying the resource requirements and detailed plan for the Office of Chief Scientist for Human Factors to assume these new responsibilities. Recommendation 4 addresses resource issues.

Recommendation 2: Amend AMS policy and/or guidance to clarify roles and responsibilities for human factors activities in all phases of the acquisition lifecycle.

Objective:

The Human Factors Process Group's evaluation of the AMS policy and guidance documents indicates the need to make relatively minor changes to the AMS policy itself. The primary objective of this recommendation is to make changes in the AMS policy/guidance documents to clarify the activities and related roles and responsibilities for performing human factors activities throughout the acquisition lifecycle.

Problems Addressed:

The Human Factors Process Group's second recommendation is designed specifically to address problems related to:

- Finding 2: The lack of adequate human factors analyses and user involvement during the MA and IA phases of the acquisition lifecycle.
- Finding 3: Human factors considerations are given little weight in PT/ IPT decisions during the SI phase of the acquisition lifecycle.

In addition, components of this recommendation will support improvement in the communication of human factors issues among relevant organizations, including communication to high-level FAA decision makers (Finding 4).

Key Components of Recommendation:

A subgroup of human factors experts from the Human Factors Process Group developed a detailed product that outlines the activities associated with an effective human factors program supporting the acquisition process. This section outlines the four broad categories of human factors functions covered by the Human Factors Process Group's recommendations and identifies key components of the group's recommendation. Appendix D presents a more detailed explanation of the required human factors activities. Figure 3 details a human factors roles and responsibilities matrix.

The range of activities that are required in an effective FAA human factors process can be grouped into four broad functions:

- Manage the human factors program;
- Establish human factors requirements;
- Conduct human factors system integration; and
- Conduct human factors test and evaluation.

Figure 3 Human Factors/User Involvement Roles and Responsibilities Matrix	
Action	Roles/ Responsibilities
<i>Activities Supporting All Phases of the Acquisition Lifecycle</i>	
Develop human factors policy and infrastructure including the development and updating of human factors guidelines and conventions	<ul style="list-style-type: none"> Office of Chief Scientist for Human Factors develops the human factors policy FAA LOBs review and comment on policy Office of Chief Scientist for Human Factors identifies human factors infrastructure requirements (e.g. laboratories, equipment, guidelines, competency model) and develops recommended solutions JRC approves funding priorities
Coordinate and integrate the R,E&D, F&E, and OPS funded FAA human factors activities/projects	<ul style="list-style-type: none"> Office of Chief Scientist for Human Factors develops recommendations for coordinated FAA program and identifies potential duplication and/or disconnects in existing or proposed projects JRC approves funding priorities
Plan for budget to support user involvement in human factors activities throughout the acquisition lifecycle	<ul style="list-style-type: none"> Office of Chief Scientist for Human Factors will coordinate and aid LOBs and IPTs in developing annual projections LOBs and IPTs will provide information required to support planning
Present human factors issues that cannot be resolved at the PT/IPT, MA, or IA team levels or that exceed the empowerment boundaries of these teams	<ul style="list-style-type: none"> Office of the Chief Scientist for Human Factors is responsible for ensuring that these issues are raised at the IMT, IPLT, or JRC level as appropriate.
Develop and present the semi-annual status report on human factors in the FAA	<ul style="list-style-type: none"> The Chief Scientist for Human Factors will prepare and deliver this status report JRC will schedule briefing JRC and Union representatives will provide feedback and comment
<i>Activities Supporting the MA Phase of the Acquisition Lifecycle</i>	
Establish MA Teams	<ul style="list-style-type: none"> The sponsoring LOB establishes and leads the MA team MA team lead notifies the Union Technical Liaisons and Office of Chief Scientist for Human Factors that an MA team has been established
Designate Human Factors Coordinator (HFC) to support MA Team	<ul style="list-style-type: none"> Office of Chief Scientist for Human Factors designates the HFC in consultation with the MA team lead
Identify opportunities for human factors analyses and appropriate human factors data to be considered in MA	<ul style="list-style-type: none"> HFC responsible to lead this action

Figure 3 Human Factors/User Involvement Roles and Responsibilities Matrix	
Action	Roles/ Responsibilities
Conduct human factors analyses to support MA	<ul style="list-style-type: none"> • HFC leads planning and provides technical direction or assistance with analyses • Human Factors Working Group (HFWG) established by HFC may conduct actual analyses using resources such as simulation laboratories at the William J. Hughes Technical Center
Identify requirements for users to serve as subject matter experts in human factors analyses	<ul style="list-style-type: none"> • HFC identifies the requirements for a valid, representative sample in conjunction with MA team lead and Union Technical Liaison(s)
Develop and submit official requests for user involvement in MA human factors analysis	<ul style="list-style-type: none"> • MA team lead prepares request with support from HFC
Process requests for user involvement	<ul style="list-style-type: none"> • The appropriate LOB organizations (e.g., ATX and AFZ) process requests in accordance with terms of collective bargaining agreements
Develop human factors input for MNS	<ul style="list-style-type: none"> • HFC in conjunction with HFWG and other members of the MA team draft human factors input
Develop union perspective section for MNS	<ul style="list-style-type: none"> • Technical Liaisons from affected unions write this section of the MNS
Prepare final MNS and appropriate briefings and submit to JRC	<ul style="list-style-type: none"> • MA Team prepares and submits all necessary documents • MA team lead notifies the HFC and Union Technical Liaisons when JRC meeting on MNS is scheduled
Respond to JRC questions on MNS human factors issues	<ul style="list-style-type: none"> • HFC from MA Team provides response with support from other team members
Respond to JRC questions on union perspective in MNS	<ul style="list-style-type: none"> • Appropriate Union Technical Liaison provides response to questions on issues raised by his/her union
<i>Activities Supporting the IA Phase of the Acquisition Lifecycle</i>	
Establish Investment Analysis (IA) Teams	<ul style="list-style-type: none"> • Office of System Architecture and Investment Analysis (ASD) establishes IA team • IA team lead notifies Union Technical Liaisons and Office of Chief Scientist for Human Factors that team has been established

Figure 3 Human Factors/User Involvement Roles and Responsibilities Matrix	
Action	Roles/ Responsibilities
Establish team to develop the Requirements Document	<ul style="list-style-type: none"> The LOB sponsoring the MNS for which the IA is conducted establishes a requirements team The leader of the requirements effort notifies Union Technical Liaisons and Chief Scientist for Human Factors that the requirements team has been established
Designate Human Factors Coordinator (s) (HFC) to support IA Team and Requirements Team	<ul style="list-style-type: none"> Office of Chief Scientist for Human Factors designates an HFC (s) in consultation with IA and requirements team leads
Identify opportunities for human factors analyses and appropriate human factors data to be considered in IA and requirements development process	<ul style="list-style-type: none"> HFC(s) responsible to lead this action
Conduct human factors analyses to support IA and requirements development	<ul style="list-style-type: none"> HFC leads planning and provides technical direction or assistance with analyses Human Factors Working Group (HFWG) established by HFC may conduct actual analyses using resources such as simulation laboratories at the William J. Hughes Technical Center
Identify requirements for users to serve as subject matter experts in human factors analyses for IA and requirements development	<ul style="list-style-type: none"> HFC identifies the requirements for a valid, representative sample in conjunction with team leads and Union Technical Liaison(s)
Develop and submit official requests for user involvement in IA and requirements human factors analysis	<ul style="list-style-type: none"> IA team lead prepares and submits IA request(s) with support from HFC Requirements team 1 prepares and submits Requirements development request(s) with support from the HFC
Process requests for user involvement	<ul style="list-style-type: none"> The appropriate LOB organizations (e.g., ATX and AFZ) process requests in accordance with terms of collective bargaining agreements
Develop human factors input for the Investment Analysis Report, the Acquisition Program Baseline (APB), and Requirements Document (RD)	<ul style="list-style-type: none"> HFC prepares human factors input in conjunction with HFWG and other members of the IA and requirements teams
Develop union perspective section for Investment Analysis Report, APB, and RD	<ul style="list-style-type: none"> Technical Liaisons from affected unions write the union perspective sections for these three documents
Prepare final Investment Analysis Report, APB, and RD with appropriate briefings and submit to JRC	<ul style="list-style-type: none"> The IA and requirements teams prepare and submit all necessary documents The IA team lead notifies the HFC and Union Technical Liaisons when the JRC investment decision meeting is scheduled

Figure 3 Human Factors/User Involvement Roles and Responsibilities Matrix	
Action	Roles/ Responsibilities
Respond to JRC questions on Investment Analysis Report, APB, or RD human factors issues	<ul style="list-style-type: none"> HFC from IA or Requirements Team provides response with support from other team members
Respond to JRC questions on union perspective in Investment Analysis Report, APB, or RD	<ul style="list-style-type: none"> Appropriate Union Technical Liaison provides response to questions on issues raised by his/her union
<i>Activities Supporting the SI Phase of the Acquisition Lifecycle</i>	
Assign acquisition program to IPT after investment decision	<ul style="list-style-type: none"> JRC makes assignment
Notify Union Technical Liaisons and Office of Chief Scientist for Human Factors of new acquisition program	<ul style="list-style-type: none"> Appropriate IPT/PT lead provides the notifications to these representatives. The tentative schedule for preparation of the Acquisition Strategy Paper (ASP) and Integrated Program Plan (IPP) will be provided to the Union Technical Liaisons
Assign human factors expert to support IPT/PT	<ul style="list-style-type: none"> Office of Chief Scientist for Human Factors, in consultation with the IPT leader, will assign or approve (if AAR-100 resources are not available) a human factors expert to the IPT/PT
Identify opportunities for human factors analyses and appropriate human factors data to be considered during the SI phase	<ul style="list-style-type: none"> Human Factors expert on IPT/PT is responsible to lead this action
Conduct human factors analyses to support the acquisition program including operability assessments leading to formal test and evaluation activities	<ul style="list-style-type: none"> Human Factors expert on the IPT/PT provides technical direction or assistance with analyses Actual analyses may be conducted by internal FAA resources or through contractor support to the IPT/PT
Identify requirements for users to serve as subject matter experts in human factors analyses throughout the SI phase including operability assessments	<ul style="list-style-type: none"> Human Factors expert on the IPT/PT will work in conjunction with other IPT/PT team members to identify the requirements for a valid, representative sample
Develop and submit official requests for user involvement in human factors analyses supporting the acquisition program	<ul style="list-style-type: none"> The IPT/PT team lead will prepare and submit request(s) with support from the human factors expert on the team
Process requests for user involvement	<ul style="list-style-type: none"> The appropriate LOB organizations (e.g., ATX and AFZ) process requests in accordance with terms of collective bargaining agreements
Develop human factors input for the IPT/PT products including the ASP, IPP, Screening Information Requests, Statements of Work, Contract Documents, etc.	<ul style="list-style-type: none"> Human Factors expert on the PT/IPT will prepare the human factors input in conjunction with other members of the team

Figure 3 Human Factors/User Involvement Roles and Responsibilities Matrix	
Action	Roles/ Responsibilities
Develop union perspective section for ASP and IPP	<ul style="list-style-type: none"> • Technical Liaisons from affected unions write the union perspective sections for these three documents
Prepare final ASP and IPP with appropriate briefings and submit to JRC	<ul style="list-style-type: none"> • The PT/IPT prepares and submits all necessary documents • The PT/IPT lead notifies the Union Technical Liaisons when the JRC meeting to discuss the ASP/IPP is scheduled
Respond to JRC questions on ASP and IPP human factors issues	<ul style="list-style-type: none"> • IPT/PT will provide response with assistance from human factors expert on the team
Respond to JRC questions on union perspective in ASP and IPP	<ul style="list-style-type: none"> • Appropriate Union Technical Liaison provides response to questions on issues raised by his/her union
Develop human factors/ human performance data collection plans for test and evaluation activities	<ul style="list-style-type: none"> • Human factors expert will work with the appropriate IPT/PT members to develop these plans

As shown in Figure 4, these human factors functions must be integrated within the acquisition process. It should be emphasized that these human factors functions typically are carried out in collaboration with subject matter experts from other technical disciplines.

The Human Factors Process Group's recommendation related to clarification of human factors roles and responsibilities in the AMS includes the actions listed below.

- Change the AMS policy document for the mission analysis phase to include evaluation of human factors issues as part of the mission analysis activities.
- Amend the AMS guidance documents to reflect specific human factors activities recommended for each phase of the acquisition lifecycle to include greater use of techniques such as prototyping, modeling, and simulation with user involvement (e.g., utilizing laboratories available at the William J. Hughes Technical Center) and conducting operability assessments throughout the SI phase. Operability assessments using operational personnel with partially functional prototypes will build in scope and complexity throughout the SI phase and culminate in more sophisticated measurement of human performance during Operational Test and Evaluation (OT&E). This strategy is expected to result in early identification of many human factors issues that are currently surfaced during OT&E. The details of the activities to be included in these guidance documents are provided in Appendix D.

**FIGURE 4: HUMAN FACTORS IN THE FAA LIFECYCLE ACQUISITION MANAGEMENT PROCESS
(COTS, NDI & Developmental Programs)**

ACTION	PHASE	MISSION ANALYSIS	INVESTMENT ANALYSIS	SOLUTION IMPLEMENTATION	IN-SERVICE MANAGEMENT (INCLUDING SERVICE LIFE EXTENSION)
MANAGE THE HUMAN FACTORS PROGRAM		<ul style="list-style-type: none"> • Identify Human Performance Deficiencies • Identify Opportunities to Improve Human Performance • Initiate Human Factors Goals and Objectives 	<ul style="list-style-type: none"> • Designate Human Factors Coordinator • Establish Human Factors Working Group • Develop the Human Factors Program • Draft Human Factors Considerations for Input to the IPP 	<ul style="list-style-type: none"> • Refine the Human Factors Program • Prepare the Human Factors Portion of the IPP 	<ul style="list-style-type: none"> • Refine the Human Factors Program • Revise the Human Factors Portion of IPP
ESTABLISH HUMAN FACTORS REQUIREMENTS		<ul style="list-style-type: none"> • Identify Human Factors and Human Resource Constraints 	<ul style="list-style-type: none"> • Establish Human Factors Requirements in Acquisition Documents • Formulate Draft Human Factors Requirements for a System Specification • Generate Initial Human Factors Requirements for a SOW 	<ul style="list-style-type: none"> • Revise Human Factors Requirements in the System Specification • Refine Human Factors Requirements in the SOW • Specify Human Factors Requirements for Source Selection 	<ul style="list-style-type: none"> • Update Human Factors Requirements for System Modifications and Upgrades
CONDUCT HUMAN FACTORS SYSTEM INTEGRATION		<ul style="list-style-type: none"> • Identify Potential Human Factors Analyses and Trade-offs 	<ul style="list-style-type: none"> • Provide Human Factors Inputs to Acquisition Documents • Initiate Human Factors Tasks and Activities • Coordinate Human Factors Tasks and Activities with ILS 	<ul style="list-style-type: none"> • Revise Human Factors Inputs to Acquisition Documents • Continue Human Factors Tasks and Activities • Coordinate Results of Human Factors and ILS Analyses 	<ul style="list-style-type: none"> • Monitor Results of Human Factors and ILS Activities
CONDUCT HUMAN FACTORS TEST AND EVALUATION			<ul style="list-style-type: none"> • Draft/Revise Human Factors Inputs for T&E Plans • Conduct Front-end Analysis 	<ul style="list-style-type: none"> • Revise Human Factors Inputs to T&E Plans • Participate in Developmental and Operational Testing 	<ul style="list-style-type: none"> • Monitor Human Factors Test and Evaluation Activities • Conduct Post-Deployment Assessments

- Amend AMS guidance to designate organizational responsibilities for initiating, reviewing, participating in, and communicating the results of various human factors activities throughout the acquisition lifecycle. The roles and responsibilities matrix in Figure 3 represents the Human Factors Process Group's recommendations for assignment of these roles and responsibilities.
- Amend AMS document templates and instructions as appropriate to incorporate additional human factors information (e.g. human factors considerations in the MNS) and other Human Factors Process Group recommendations (e.g., add union perspective section to appropriate templates).
- Expand the AMS policy document to explicitly incorporate the role of human factors R,E&D efforts. This recommendation will be focused on the role of these efforts in the MA and IA phases of the acquisition lifecycle.

Implementation Issues:

While the required changes to the AMS policy/guidance documents can be made relatively quickly and with minimum expenditure of resources, the successful implementation of the activities added to the AMS policy/guidance documents is dependent on implementation of the changes to the resourcing of human factors described in Recommendation 4.

Recommendation 3: Establish Technical Liaison positions within the NATCA, PASS, and NAATS organizations to provide union involvement at designated points in the acquisition lifecycle.

Objective:

The ultimate objective of the Human Factors Process Group's recommendation related to union involvement at designated points in the acquisition lifecycle is to increase the likelihood of user acceptance of the systems acquired through the AMS. The Human Factors Process Group recognizes that its recommendation related to formal union involvement in the acquisition process will be viewed as a major policy change for the FAA.

The establishment of a formal mechanism to ensure union involvement throughout the acquisition lifecycle is an action that complements and reinforces the Human Factors Process Group's first two recommendations related to the integration and management of human factors in the acquisition lifecycle. To be successful in identifying and resolving human factors issues, human factors professionals must work closely and collaboratively with operational users. This collaboration includes obtaining information on general user concerns related to a system as well as collecting data from subject matter experts in human factors activities focused on specific operability issues. There are often a range of potential solutions available for human factors problems. Clear understanding of user concerns will assist the FAA in assessing the likelihood of successes or risks associated with each alternative.

Problems Addressed:

The Human Factors Process Group's recommendation to formally include affected unions at designated points in the acquisition lifecycle is designed to specifically address problems associated with two major findings:

- Finding 4: Human factors issues and user concerns are often not communicated to high-level decision makers (e.g., managers on the IPLT or JRC).
- Finding 5: There is currently no formal mechanism for union involvement within the AMS.

In addressing the above findings, the recommendation will also outline a formal role for the unions in the identification and communication of user concerns related to human factors in FAA acquisition programs.

The Human Factors Process Group recognizes that the STARS Human Factors Steering Committee Support Group has considerable interest in how this recommendation affects the likelihood of union bargaining related to Impact and Implementation (I&I) issues late in the acquisition lifecycle. One of the principal problems leading to union bargaining related to implementing new technology programs is that affected unions believe their concerns have not been adequately addressed throughout the acquisition lifecycle. The Human Factors Process Group's recommendation provides a method for these concerns to be voiced and responsibly considered/addressed by FAA management. The report section on benefits and risks further addresses these issues.

Key Components of Recommendation:

The Human Factors Process Group recommendation in this area identifies:

- A framework for structuring union involvement in the FAA's acquisition lifecycle;
- The role to be performed by the union's Technical Liaisons; and
- The points in the acquisition lifecycle when the Technical Liaisons should be involved.

The details on how this recommendation will be implemented within each of the unions must be addressed as part of the implementation planning referenced in Recommendation 5. The major elements of the Human Factors Process Group's recommendation on user involvement are outlined below.

- The mechanism for union involvement within the FAA's acquisition lifecycle should be structured using the principles outlined in the Federal Labor Relations Authority (FLRA) Guidance Memorandum on "pre-decisional

involvement” (7/15/97). This memorandum is provided as Appendix C. The memorandum outlines a process for involving unions in federal agency activities that do not infringe upon management’s exclusive rights or the unions’ rights for bargaining as specified in the Federal Service Labor-Management Relations Statute (Section 7106). Union involvement will occur prior to FAA management making decisions. The process outlined in the FLRA Guidance Memorandum provides a mechanism by which the unions can directly provide input in the acquisition lifecycle without the risk of violating the statute.

- The Human Factors Process Group spent considerable time discussing the role of the Technical Liaisons. The group identified a number of basic functions/responsibilities associated with these positions. More detailed roles and responsibilities associated with the Technical Liaison positions must be defined during implementation planning. The specifics of how these positions will be implemented may vary by union. However, the basic functions/responsibilities should remain the same.

The primary intent in establishing the Technical Liaison positions is to provide a clearly specified point of contact within each union for acquisition-related issues. It is envisioned that the Technical Liaison positions will be a full time role, to ensure consistent involvement by an informed union representative as acquisition activities progress through the MA, IA, and early SI phases of the acquisition lifecycle. The Technical Liaisons will have a “big picture” acquisition perspective as compared to the program-specific view required by union members now functioning as product representatives on many FAA acquisition programs. The newly formed Technical Liaisons will provide expertise to FAA acquisition teams through the development of the Acquisition Strategy Paper (ASP) and Integrated Program Plan (IPP).

The Technical Liaison will attend FAA meetings related to acquisition programs in the MA, IA, and early SI phases of the acquisition lifecycle, assist in identifying additional user expertise required for human factors activities in early phases of the acquisition lifecycle, serve as the primary conduit for communicating user concerns in meetings (including relevant JRC sessions), and prepare/coordinate union review and input for the acquisition products specified below.

- The Human Factors Process Group identified specific phases and products in the acquisition lifecycle that should include involvement by the unions’ Technical Liaisons. The AMS policy/ guidance should be amended to include involvement of these Technical Liaisons beginning with the development of the Operations Concept in the MA phases through the development of the IPP in the SI phase. As part of the formal mechanism of union involvement, the Human Factors Process Group recommends that the templates for the MNS,

IA Report, Final Requirements Document, APB, ASP, and IPP all be amended to include a “Union Perspective” section. This section will be completed by the Technical Liaisons from the affected collective bargaining units and provide a direct means for unions to voice their concerns to the JRC and other FAA management officials reviewing these AMS products.

- In concert with the recommendation to provide a formal mechanism for documenting the union perspective in relevant acquisition products, the Human Factors Process Group recommends that the Technical Liaisons attend relevant JRC meetings at which they can participate in briefings, answer questions, and provide input to clarify their positions on key issues. The unions’ role in these meetings is informational in nature and does not include participation in the actual JRC decision process.

Implementation Issues:

Just as the Office of the Chief Scientist is not currently resourced to support Recommendation 1, PASS is not currently structured to support this recommendation on improved union involvement. In fact, throughout the STARS human factors effort, PASS has experienced difficulty in supporting the activities through the current practice of obtaining personnel from field facilities. Therefore, a requirement for successful implementation of the Human Factors Process Group recommendation for establishing formal union involvement in the AMS is the formation of a Technical Liaison team that will alleviate problems associated with obtaining systems specialists from field facilities to provide the ongoing support needed for improved user involvement from this union.

The implementation of this recommendation will require the development of formal agreements between the FAA and the affected unions. The FAA’s Office of the Chief Council (AGC) and Office of Human Resource Management (AHR) must participate in an expeditious effort to implement these formal agreements.

Recommendation 4: Establish mechanisms to allocate and manage resourcing of human factors and user involvement activities in all phases of the acquisition lifecycle.

Objective:

The primary objective of this recommendation is to ensure that adequate resources are made available to execute an effective human factors program that includes sufficient user involvement and analyses to reduce the occurrence of major human factors problems in FAA acquisition programs. Without resolution of resourcing impediments to FAA’s human factors activities, it will be impossible to successfully implement the Human Factors Process Group’s other recommendations.

The Human Factors Process Group recognizes the constrained fiscal environment in which the FAA currently exists, but believes that the investments in greater user involvement and

better integration of human factors in acquisition programs will ultimately reduce costs. With regard to human factors and user involvement, we are dealing with a “pay me now or pay me later” situation in which the later costs also carry significant program schedule impacts. The Human Factors Process Group’s recommendations related to resourcing of human factors activities include specific recommendations for addressing both funding and personnel resource constraints.

Problems Addressed:

Implementation of the Human Factors Process Group’s recommendations related to increased resourcing of human factors activities in the acquisition lifecycle will directly address specific problems associated with four of the group’s major findings:

- Finding 1: The lack of an overall human factors management structure and process to coordinate human factors resources/programs within the FAA.
- Finding 2: The lack of adequate human factors analyses and user involvement during the MA and IA phases of the acquisition lifecycle.
- Finding 3: Human factors considerations are given little weight in PT/ IPT decisions during the SI phase of the acquisition lifecycle.
- Finding 6: There is inadequate coordination, planning, and management of resources for human factors in the acquisition lifecycle.

Key Components of Recommendation:

The Human Factors Process Group’s recommendations for more effective resourcing for human factors and user involvement in acquisition programs include establishment of new sources of funding, coordination of funding prioritization across programs funded through different appropriations, and more efficient use of resources allocated to human factors and user involvement. Key elements in this recommendation include:

- Establishing funding for human factors activities in the MA and IA phases of the acquisition lifecycle. It is anticipated that the level of funding required in these phases is relatively small (from an F&E perspective), but essential to support increased human factors analyses needed to ensure that critical issues or human factors constraints are identified prior to SI. These activities will directly support development of an APB that includes realistic resource and schedule considerations for required human factors activities.
- Improving coordination of human factors R,E&D projects to ensure that they complement F&E and OPS human factors activities to the maximum extent possible. The details of the process by which this improved coordination will take place must be developed by the Office of Chief Scientist for Human Factors when it assumes the role of lead FAA human factors organization.

- Ensuring that APBs include adequate resources for human factors activities throughout the SI phase, including test and evaluation activities. APB budgets should include a line item for human factors activities. This portion of the recommendation is dependent upon the availability of better human factors data within the IA phase. Assuming such data becomes available, it is the responsibility of the Office of Chief Scientist for Human Factors to advise/assist the JRC in its evaluation of adequacy of resources for human factors activities included in new APBs.
- Establishing mechanisms to fund adequate user involvement by operational personnel from field facilities. The issue of funding the costs of increased user involvement has several components. Decisions must be made regarding responsibilities for improved planning that will allow more accurate budgeting for these costs, and a consistent policy related to responsibility for payment of facility overtime costs associated with user involvement in human factors evaluations must be established.
- Providing education on the appropriate mechanisms and considerations for obtaining user involvement is a relatively easy but essential action that is required to ensure that fiscal resources are not wasted and that personnel resources are used efficiently. Once awareness of these considerations has been clearly communicated to the necessary parties, they must be held accountable for exercising reasonable discipline in following the appropriate procedures.
- The final component of the recommendations related to resourcing is the establishment or allocation of the appropriate number of human factors positions to support improved human factors activities throughout the acquisition lifecycle. Once the number of additional human factors positions has been determined and approved, all of the human factors positions associated with support to acquisition activities must be reviewed to ensure they are funded appropriately.

Implementation Issues:

Implementing several components of this recommendation will require action by the highest levels of management within the FAA and support or action within Congress. The budgets approved for FY 1998 and submitted for FY 1999 do not include the resources required to support human factors activities required in the MA and IA phases of the acquisition lifecycle. The Human Factors Process Group, recommends that the Office of Chief Scientist for Human Factors, develop an estimate of the resources required by this recommendation. Therefore, implementation of the Human Factors Process Group's recommendations in this area will require action by the JRC to reprogram funds. Such action is subject to approval by Congress. The Human Factors Process Group believes that these implementation issues must be highlighted in the transmittal of FAA's final

report to Congressman Wolf and/or during any final briefing provided to Congressman Wolf on the prevention of human factors problems in future FAA acquisition programs.

Recommendation 5: Establish a mechanism and implementation plan to ensure that the Human Factors Process Group recommendations are acted upon in a timely manner.

Objective:

The Human Factors Process Group recognizes that the lack of accountability and role clarity affecting the management of human factors activities cited as a problem in the acquisition system is also likely to affect the implementation of the recommendations developed by this group. Previous efforts to address many of the same human factors problems have been unsuccessful because implementation of the recommendations faltered or was not planned with sufficient detail and accountability. Therefore, the final recommendation developed by the Human Factors Process Group is designed to mitigate the risk of this group's recommendations meeting the fate of previous groups' efforts.

Problems Addressed:

The final Human Factors Process Group recommendation is designed primarily to address the lack of accountability in the human factors area that is associated with:

- Finding 1: The lack of an overall human factors management structure and process to coordinate human factors resources/programs within the FAA.

The implementation planning associated with this recommendation will, however, ultimately impact the adequacy with which we address the majority of the problems identified by the Human Factors Process Group.

Key Components of Recommendation:

The Human Factors Process Group's final recommendation is focused on follow-on actions required to refine, implement, and monitor progress on the implementation of Recommendations 1-4. The recommendation has two major components as outlined below.

- Assuming that the FAA Administrator approves the recommendations contained in this report, the STARS Human Factors Steering Committee Support Group or the Reconstituted STARS Human Factors Steering Committee must provide the Administrator with an executable, implementation plan within 60 days of the Administrator's approval of the recommendations. This plan must contain specific milestones with clear accountability for implementing the Human Factors Process Group recommendations, with particular attention to implementation of the recommendations for establishment of the Chief Scientist for Human Factors as the lead FAA human

factors organization and the establishment of the formal mechanism for union involvement in the AMS.

- The lead FAA human factors organization must establish a mechanism for semi-annual reporting to the FAA Acquisition Executive and JRC on the status of human factors in FAA acquisitions. This reporting will occur in an interactive setting in which the unions have the opportunity to participate. The first of these reporting sessions must occur prior to the end of Fiscal Year 1998.

Implementation Issues:

If the Human Factors Process Group's recommendations are approved, the Steering Committee or Steering Committee Support Group must act quickly to establish responsibilities for detailed implementation planning. If possible, some portion of the existing Human Factors Process Group should be included in the implementation planning effort to ensure continuity of the underlying rationale associated with the recommendations.

BENEFITS AND RISKS ASSOCIATED WITH RECOMMENDATIONS

There are a number of potential benefits and risks associated with the Human Factors Process Group's recommendations. The following sections provide a brief discussion of these potential benefits and risks.

Benefits

The overall, direct benefit of implementing the Human Factors Process Group's recommendations will be a significant increase in the likelihood that the FAA fields acceptable systems with a minimum of human factors problems, while remaining within the cost and schedule baselines established for the acquisition program. Ultimately, this will allow the FAA to provide more effective and efficient services to its external customers including the flying public. More directly, realization of this benefit will result in a situation in which the constituencies of all representatives participating in the Human Factors Process Group are winners:

- The users will receive systems that meet their needs with a minimum of training, operations, and maintenance problems.
- The management of FAA's operational lines of business will receive the capabilities they require to meet their customer's needs in a more timely and less painful fashion.
- The IPTs and other organizational elements responsible for implementation of the AMS will have more highly satisfied customers and be in a better position to meet the FAA's goals to reduce acquisition lifecycle time and costs.
- The human factors community will have the opportunity to make significant contributions throughout the acquisition lifecycle, beginning in the earliest stages of mission analysis and research and development.

Figure 5 provides a matrix of specific benefits that will result from implementation of the Human Factors Process Group's recommendations linked to the constituencies most affected by each benefit.

Risks

The Human Factors Process Group recognizes the implementation of their recommendations also poses a number of potential risks. In general, these risks will be shared by all FAA organizations. The items listed below are the potential risks associated with the recommendations proposed by the Human Factors Process Group.

- Successful implementation of the recommendations will be difficult due to organizational resistance to changes, perceived loss of control over program activities, resource requirements associated with building the appropriate

infrastructure, lack of trust among organizations affected, and management issues associated with implementation .

- There is a potential for negative impact on program cost and schedule baselines if the recommendations are not implemented effectively.
- Sufficient resources to effectively implement the recommendations may not be made available, or at least not available in the near future.
- The process leading to the investment decision may take longer with increased time requirements in the early phases. However, acquisition decisions should be better.*

* Adapted from Guidance Memorandum, Subject: *Pre-Decisional Involvement: A Team Based Approach Utilizing Interest-Based Problem Solving Principals*, July 15, 1997, Office of the Chief Counsel, Federal Labor Relations Authority.

Figure 5: Benefits of Human Factors Process Group Recommendations

BENEFIT	CONSTITUENTS DIRECTLY ACCRUING BENEFIT			
	Users/Unions	FAA LOB Management	Acquisition Community	Human Factors Community
<ul style="list-style-type: none"> Positively impacts the safety and efficiency of controller operations as a result of more effective human factors contributions to achievement of more seamless interfaces across ATC system domains and components within a domain. 	✓	✓		
<ul style="list-style-type: none"> Decreases time required to successfully field systems, reduces acquisition costs, and improves operational effectiveness due to early identification and resolution of problems related to human factors and user acceptability. 	✓	✓	✓	
<ul style="list-style-type: none"> Increases the coordinated and consistent application of human factors policy, approaches, tools, techniques, data, and metrics across research and system application domains and throughout all phases of the acquisition lifecycle. 		✓	✓	✓
<ul style="list-style-type: none"> Improves the effective and efficient use of human factors resources across the agency thereby contributing to savings in time and money. 		✓	✓	✓
<ul style="list-style-type: none"> Increases accountability for FAA human factors quality assurance through designation of a lead FAA human factors organization and clarification of human factors roles and responsibilities in AMS. 		✓	✓	✓
<ul style="list-style-type: none"> Reduces the probability that human factors issues will be significant collective bargaining issues. 	✓	✓		

Figure 5: Benefits of Human Factors Process Group Recommendations

BENEFIT	CONSTITUENTS DIRECTLY ACCRUING BENEFIT			
	Users/Unions	FAA LOB Management	Acquisition Community	Human Factors Community
<ul style="list-style-type: none"> Further aligns FAA's AMS to President's partnership concept expressed in Executive Order 12871, October 1993 and the National Performance Review Objectives. 	✓	✓	✓	
<ul style="list-style-type: none"> Increases the quality of acquisition decisions, because the employees who perform the work of the FAA and will use the systems and software acquired will have input into the decision-making process. Through this process, they explore and evaluate system and software solutions that might otherwise have gone unnoticed.* 	✓	✓	✓	
<ul style="list-style-type: none"> Increases the ownership stake in the full implementation of acquisition decisions that are supported by employees who are responsible for performing work using acquired systems and software. 	✓	✓	✓	
<ul style="list-style-type: none"> Increases the level of support for acquisition decisions because they are better understood, both as to their origin and their intent, by those who are charged with implementing the acquisition decisions.* 	✓	✓	✓	

* Adapted from Guidance Memorandum, Subject *Pre-Decisional Involvement: A Team Based Approach Utilizing Interest-Based Problem Solving Principals*, July 15, 1997, Office of the Chief Counsel, Federal Labor Relations Authority.

Figure 5: Benefits of Human Factors Process Group Recommendations

BENEFIT	CONSTITUENTS DIRECTLY ACCRUING BENEFIT			
	Users/Unions	FAA LOB Management	Acquisition Community	Human Factors Community
<ul style="list-style-type: none"> Increases the chance for timely implementation of new systems and software because the risk of deployment and implementation delay caused by attempts to impede or delay implementation of perceived poor acquisition decisions is greatly reduced^f 		✓	✓	
<ul style="list-style-type: none"> Facilitates any subsequent collective bargaining on system or software acquisition. During collective bargaining about system or software acquisition issues under the Federal Service Labor-Management Relations Statute after the pre-decisional involvement process, it is highly likely that the parties have narrowed the issues, better understand the other's interests and preferred option, and have built more trust in their dealings with each other around acquisition issues.¹ 	✓	✓		

* Adapted from Guidance Memorandum, Subject *Pre-Decisional Involvement: A Team Based Approach Utilizing Interest-Based Problem Solving Principals*, July 15, 1997, Office of the Chief Counsel, Federal Labor Relations Authority.

- Additional personnel and administrative costs may be incurred to support union involvement in the pre-decision process. Although the total lifecycle costs are likely to decrease in the long-term due to earlier problem identification and faster implementation.*
- Even with success in implementing the recommendations, collective bargaining under the Federal Service Labor-Management Relations Statute will be necessary. *

While the potential risks identified above may be viewed as significant, the Human Factors Process Group believes that they are far outweighed by the potential benefits associated with the group's recommendations. These risks were also considered to be relatively low compared to the potential risks associated with maintaining the status quo on user involvement and human factors.

* Adapted from Guidance Memorandum, Subject: *Pre-Decisional Involvement: A Team Based Approach Utilizing Interest-Based Problem Solving Principals*, July 15, 1997, Office of the Chief Counsel, Federal Labor Relations Authority.

CONCLUSIONS AND NEXT STEPS

Impact on AMS and IPDS

The recommendations developed by the Human Factors Process Group require only minor changes in the overall AMS policy and the IPDS structure through which the AMS is implemented for major FAA acquisition programs. While the impacts on AMS and IPDS policies themselves are relatively minor, the group's recommendations have significant implications for the manner in which these policies are implemented within the FAA. These major policy issues are summarized in the next section.

FAA Policy Issues

The recommendations from the Human Factors Process Group have significant policy implications in three areas:

- Formal union involvement in early phases of the acquisition lifecycle;
- FAA's structure and process for management of human factors; and
- FAA funding for human factors.

Union Involvement. The issue of formal union involvement in the early phases of the acquisition lifecycle was thoroughly discussed by the Human Factors Process Group. While there was clear agreement concerning need for more user involvement throughout the acquisition lifecycle, the establishment of a formal mechanism for providing union input in the MA and IA stages of the acquisition lifecycle was viewed as a major change in FAA policy.

The conclusion reached by the Human Factors Process Group was that the unions' perspectives regarding the acceptability of new systems will ultimately affect most major acquisition programs. The question at hand is whether the FAA is better served by establishing a formal mechanism for voicing this perspective early in the acquisition lifecycle or by waiting for this perspective to be "discovered" through the involvement of individual union members as subject matter experts in acquisition activities such as test and evaluation or through other channels such as the unions voicing complaints or concerns to the DOT IG or Congress. The Human Factors Process Group believes that "smart management" dictates a change in policy that ensures union concerns are formally provided directly to FAA management as early as possible in the acquisition lifecycle. This change in policy is consistent with sound acquisition practices related to the early involvement of all major stakeholders affected by acquisition programs as well as the FLRA policies on pre-decisional involvement of federal unions in agency decision making.

FAA Human Factors Management Structure. Approval of the recommendation to increase the resources and responsibilities of the Office of Chief Scientist for Human Factors to better assume the lead role for management of human factors in both R,E&D

and acquisition areas also reflects a significant policy decision. The intent of the Human Factors Process Group's recommendation is to give this office both greater control and greater accountability for planning, executing, and monitoring the FAA's overall human factors program. Centralizing this level of control and resources raises issues concerning the appropriate reporting structure and procedures for the newly enhanced human factors organization and will raise questions regarding the degree to which other organizations have autonomy in developing expertise and programs related to human factors. The Human Factors Process Group did not directly address the reporting structure and procedures for the Office of Chief Scientist for Human Factors; however, the group clearly agreed that the Chief Scientist must be positioned to voice human factors concerns at the Associate Administrator or Administrator level without the risk of these concerns being filtered through additional layers of management. The issue of appropriate reporting structure should be examined more thoroughly as part of implementation planning.

With regard to the issue of the autonomy of other organizations to acquire or develop their own human factors capabilities, the Human Factors Process Group's general position is fairly clear: the Office of Chief Scientist for Human Factors is the FAA lead in the human factors area. If this organization is to be held accountable for improving the state of human factors in the FAA, it must have the authority to set human factors policy, participate in FAA acquisition, and establish appropriate qualification standards for human factors personnel. This position does not preclude other FAA organizations from obtaining human factors contract support or hiring in-house human factors experts. Should the Office of the Chief Scientist for Human Factors not be able to provide these resources. However, the human factors expertise utilized in these organizations will be approved by the Office of the Chief Scientist for Human Factors and will represent resources used to work collaboratively with the Office of Chief Scientist for Human Factors.

In a similar vein, the resources of the Office of Chief Scientist for Human Factors devoted to the acquisition area are expected to support users in other lines of business engaged in mission and investment analysis as well as the IPTs. While the human factors experts provided by the Office of Chief Scientists have essential contributions to make on these teams, these individuals provide support to assist in the accomplishment of larger missions such as development of a MNS or implementation of a new system.

Human Factors Funding. Implementation of the recommendations of the Human Factors Process group may require increased funding in the human factors area. Of equal and perhaps greater importance from a policy perspective, the group's recommendations suggest a change in the source of this funding and changes in the manner by which the expenditure of existing human factors funding is prioritized. The Human Factors Process Group believes that establishment of funding to support human factors activities in the MA and IA phases of the acquisition lifecycle is essential to ensuring that adequate work is performed. Since the MA and IA activities occur prior to establishment of a new acquisition program this will require a funding line that is not program-specific. This action represents a significant change from existing policy regarding appropriate means of

funding human factors analyses and will require JRC action. This will require the support of the FAA Administrator and the Presidents of the unions, in discussions with Congressman Wolf and the Sub-Committee on Transportation of the House Appropriations Committee to ensure that these non-program-specific funds survive the budget process.

In addition to the establishment of the new source of funding, the Human Factors Process Group's recommendations involve changing the current policy related to prioritization of existing human factors R,E&D funds. The separation between the processes for prioritization of R,E&D funding and the prioritization of F&E funds does not provide sufficient controls to ensure that R,E&D investments complement F&E investments. Given the scarcity of FAA human factors resources and the magnitude of existing human factors challenges, this lack of efficient coordination of funds cannot be tolerated. One of the first challenges for the Office of Chief Scientist for Human Factors as the lead FAA human factors organization is to provide recommendations on policy/process changes required to ensure that the human factors R,E&D program is aligned with overall agency priorities, including acceleration of NAS modernization.

Enabling Management Actions

The Human Factors Process Group's recommendations call for a number of fairly significant changes within both the FAA and its unions. These changes are likely to be met with resistance and will only be implemented with significant support from the highest levels in the affected organizations. The ability of the affected parties to overcome the lack of trust that prevails among FAA organizations and between the FAA and the affected unions represents a major barrier that must be overcome if the Human Factors Process Group's recommendations are to succeed. There are a number of specific actions that the leaders of the affected organizations can take to support implementation of the recommendations related to improving human factors and user involvement in FAA acquisition programs:

- The highest levels of management in each organization (i.e. the FAA Administrator and NATCA, NAATS, and PASS presidents) must clearly express their support for the recommended changes.
- The highest levels of management in each organization must hold members of their respective organizations accountable for implementing the changes in a timely manner.
- The FAA Administrator must ensure that AGC and AHR are part of an expeditious effort to plan and implement key components of the recommendations related to union involvement in the acquisition process.
- The leadership of both the FAA and its unions must approach the new union involvement process with reasonable expectations. They must also ensure that the individuals representing each organization in this process are sensitive to

and committed to overcoming the existing cultural barriers that are impediments to successful implementation of such a process.

- Leaders in all of the affected organizations must build on progress made by the STARS Human Factors Steering Committee Support Group in establishing some level of trust among their respective organizations, and they must demonstrate patience and tolerance of mistakes that will inevitably occur as organizations attempt to implement the recommendations.
- The members of the STARS Human Factors Steering Committee Support Group and their respective organizations must work in a united manner to approach external organizations such as Congress or OMB to acquire or justify additional resources or changes in policy (such as establishment of non-program-specific funds) required to implement the recommendations contained in this report.

Next Steps

The completion of this report represents the final task of the Human Factors Process Group. Subsequent actions are primarily the responsibility of the STARS Human Factors Steering Support Group. The next logical steps involved in moving forward to solve the user involvement and human factors problems outlined in this report are listed below.

- The FAA Administrator, appropriate FAA Associate Administrators, and the Presidents of NATCA, NAATS, and PASS must be briefed on the recommendations.
- The FAA Administrator must decide whether the Steering Committee's recommendations will be pursued.
- The approved recommendations should be provided to Congressman Wolf to answer his question on how the FAA will avoid future human factors problems such as those that prompted the unions and the DOT IG to request a hearing with his office.
- Implementation planning and reporting mechanisms for monitoring improvements in user involvement and integration of human factors into FAA acquisition programs should proceed in accordance with the Human Factors Process Group's fifth recommendation.

ACRONYM LIST

AAD	Associate Administrator for Administration
AAF	Airway Facilities Service
AAR-100	Office of the Chief Scientist for Human Factors
AAT	Air Traffic Service
ACS	Associate Administrator for Civil Aviation Security
ACT	William J. Hughes Technical Center
AMS	Acquisition Management System
AND	Office of Communication Navigation and Surveillance Systems
APB	Acquisition Program Baseline-APB
ARA	Associate Administrator for Research and Acquisition
ARP	Associate Administrator for Airports
ARS.	Air Traffic Requirements Service
ASP	Acquisition Strategy Paper
AST	Associate Administrator for Commercial Space Transportation
ATS	Associate Administrator for Air Traffic Services
AUA	Office of Air Traffic Systems Development
AVR	Associate Administrator for Regulation and Certification
CAASD	Center for Advanced Aviation System Development
CHI	Computer Human Interface
COTS/NDI	Commercial Off the Shelf/ Non-Developmental Item
F&E	Facilities and Equipment
FLRA	Federal Labor Relations Authority
IA	Investment Analysis
I&I	Impact and Implementation
IMT	Integrated Management Team
IPDS	Integrated Product Development System
IPLT	Integrated Product Leadership Team
IPP	Integrated Program Plan
IPT	Integrated Product Team
JRC	Joint Resources Council
LOB	Line of Business
MA	Mission Analysis
MNS	Mission Need Statements
NAS	National Airspace System
NAATS	National Association of Air Traffic Specialists
NATCA	National Air Traffic Controller Association
OPS	Operations Budget
OT&E	Operational Test and Evaluation
PASS	Professional Airways Systems Specialists
PT	Product Team
R,E&D	Research Engineering and Development
SI	Solution Implementation

Appendix A

Human Factors Process Group Membership

Human Factors Process Group January-February 1998

Organization	Name	Phone & Fax	E-Mail
Facilitators from Fu Associates (non-voting member)	Earl Pence Doug Rachford	703-243-2992 703-243-6229 fax	pence@nerdvana.fu.com doug.rachford@faa.dot.gov
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MITRE (non-voting member)	Joe Celio Cathy Horton (alt.)	703-883-7599 703-883-6504	jcelio@mitre.org chorton@mitre.org
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Appendix B

Human Factors Process Group Decision Process

Human Factors Process Group Decision Process

1. Decisions will be accomplished by group consensus.
 - Consensus has been achieved when every member can say, “I have had an opportunity to express my views fully, and they have been thoughtfully considered by the group. Even though the current solution may not be the one I believe is optimal, I do believe it will work and I will support it.”
2. The voting members are the primary or alternate representatives from PASS, NATCA, NAATS, AND, ARS, AAR-100, ATO, ATX, AUA, ANS, and ACT. Each organization may cast only one vote. Current representatives are recorded in the Human Factors Process Group’s Final Report (Appendix A).
3. Absent representatives from any of the above organizations will not delay the decision process unless the absence has been previously discussed with the Group (see Group Norms).
4. Voting poll will be accomplished by:
 - Thumb up: “Agree with decision and support.”
 - Thumb sideways: “Can live with and support decision.”
 - Thumb down: “Disagree with the decision and cannot support without further discussion.”
5. Consensus is not reached if any thumb down vote is recorded. The group can continue discussion of the issue or “park” the issue to be brought back up at a later date when more information may be available.
6. Issues that cannot be brought to consensus will be elevated, with any comments, to the Steering Committee Support Group for their discussion and guidance back to the Human Factors Process Group.
7. The final report will include this Decision Process and an explanation of the modified consensus process under which the group worked. The report will note issues on which the group did not reach consensus.
8. The group reserves the right to revisit this decision process and to refine or add points of order.

Appendix C

Federal Labor Relations Authority (FLRA) Guidance Memorandum On Pre-Decisional Involvement

UNITED STATES OF AMERICA
FEDERAL LABOR RELATIONS AUTHORITY

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OFFICE OF THE GENERAL COUNSEL

July 15, 1997

GUIDANCE MEMORANDUM

TO: Regional Directors

FROM: Joe Swerdzewski, General Counsel

SUBJECT: Pre-Decisional Involvement: A Team-Based Approach Utilizing Interest-Based Problem Solving Principles - (see also the Executive Summary)

This Guidance Memorandum discusses the concept of "pre-decisional involvement" and its implementation utilizing a team-based approach which relies upon interest-based problem solving skills, techniques and strategies. It serves as guidance to the Regional Directors in educating the parties on the benefits of collaborative approaches to labor-management relations and in assisting them in their efforts to improve those relationships. This Guidance also implements the Office of the General Counsel Facilitation, Intervention, Training and Education (FITE) Policy which sets forth the principles and criteria that the Office of the General Counsel follows when working with the parties and delivering FITE activities to further the development of collaborative relationships and dispute resolution.

I am making this Guidance Memorandum available to the public to assist union officials and agency representatives in working together to develop productive labor-management relationships. This Guidance is a continuation of my office's commitment to provide the participants in the Federal Service Labor-Management Relations Program with my views on significant topics.(1) This Guidance reflects my views as the General Counsel of the Federal Labor Relations Authority and does not constitute an interpretation by the three-member Authority.

This Guidance Memorandum is divided into four parts which address the concept of pre-decisional involvement - what is it? (Part I); the benefits of engaging in pre-decisional involvement - why do it? (Part II); the relationship between pre-decisional involvement and the statutory duty to bargain - what happens after you do it? (Part III); and a step-by-step model on structuring a pre-decisional involvement process using interest-based principles and team concepts - when and how to do it? (Part IV). Attached to this Guidance is a summary of that step-by-step approach for the Regions to use when assisting the parties in designing a pre-decisional involvement process.

PRE-DECISIONAL INVOLVEMENT: A TEAM-BASED APPROACH UTILIZING INTEREST-BASED PROBLEM SOLVING PRINCIPLES

PART I. What Is Pre-Decisional Involvement and Where Did it Come From?

PART II. The Benefits of Engaging in Pre-Decisional Involvement - Why Do It?

PART III. The Relationship Between Pre-Decisional Involvement and the Statutory Duty to Bargain - What Must be Decided Before You Begin About What You Will Do After it Is Done

PART IV. The Use of Interest-Based Principles and Teams To Accomplish Pre-Decisional Involvement - A Model on When and How to Do it

Step 1. The Agency and the Union Determine if They Will Engage in Pre-Decisional Involvement Over a Particular Matter

Step 2. Representatives of the Agency and the Union Come to a Common Understanding on the Relationship Between the Pre-Decisional Involvement Process and the Statutory Duty to Bargain

Step 3. The Agency and the Union (and any Other Entities Involved in the Process) Come to a Common Understanding on the Structure of Their Pre-Decisional Involvement Process

Step 4. The Partnership Council Identifies the Interests of the Agency and Union That Must Be Satisfied by the Team's Recommendations and the Standards With Which any Solution Must be Consistent

Step 5. The Partnership Council Creates the Charge of the Team and Meets with the Team to Discuss the Charge

Step 6. The Pre-Decisional Involvement Team Meets and Reaffirms a Common Understanding Among All Team Members of their Charge And Fulfills Its Charge

Step 7. The Partnership Council Reviews the Team's Work Product and Takes Appropriate Action

A Guide to Designing a Pre-Decisional Involvement Process

PART I. WHAT IS PRE-DECISIONAL INVOLVEMENT AND WHERE DID IT COME FROM?

Simply stated, pre-decisional involvement is a term which represents those activities where employees through their elected exclusive representative are afforded by agency management the opportunity to shape decisions in the workplace which impact on the work the employees perform. In my view, pre-decisional involvement is the cornerstone of Executive Order 12871, as amended, "Labor-Management Partnerships." The preamble of the Executive Order provides that "[t]he involvement of Federal Government employees and their union representatives is essential to achieving the National Performance Review's Government reform objectives." Pre-decisional involvement is a vehicle that provides for that "involvement." It is a process where unit employees who perform the daily tasks that collectively accomplish the mission of the agency have input into a decision-making process which traditionally has excluded them as stakeholders. It does not expand the topics which are mandatorily negotiable under the Federal Service Labor-Management Relations Statute (Statute). Pre-decisional involvement does not waive management's statutory right to make decisions under section 7106 of the Statute, nor does it waive a labor organization's right to engage in bargaining prior to implementation to the extent required by the Statute. Rather, pre-decisional involvement is a process to provide for employee input as stakeholders into the decision-making process in order "to design and implement comprehensive changes necessary to reform Government" and "to champion change in Federal Government agencies to transform them into organizations capable of delivering the highest quality service to the American people." (2)

In order to be successful, however, it is critical that both parties to the relationship, labor and management:

- have a common understanding of what pre-decisional involvement, as they themselves define it, means;
- share a mutual appreciation of why it is in their own best interest to engage in pre-decisional involvement;
- have similar expectations of the results they seek to obtain from pre-decisional involvement; and
- agree on what actions occur after pre-decisional involvement has concluded.

The parties themselves must mutually agree on how they will deal with each other under this concept. When the Regions work with parties under the FITE Policy to establish a pre-decisional involvement process, the following principles of pre-decisional involvement should be fully explored:

1. The process begins early when ideas are forming;

2. The parties have common expectations;
3. Information is freely shared throughout the process and there is an understanding on confidentiality of the information and the process;
4. The participants utilize a problem solving approach founded on interest-based principles;
5. The participants adapt a team approach to their activities; and
6. The parties and the participants demonstrate a high degree of commitment to the process and to achieving their shared expectations.

Each of these principles will be explored in Part IV discussing how to engage in pre-decisional involvement. Prior to engaging in that discussion, however, I will discuss the benefits of pre-decisional involvement.

PART II. THE BENEFITS OF ENGAGING IN PRE-DECISIONAL INVOLVEMENT - WHY DO IT?

No party should engage in pre-decisional involvement unless that party believes that it is in its interest to do so. No party should engage in pre-decisional involvement unless it has willingly participated in a process to develop exactly what pre-decisional means, how it will be accomplished, what the parties hope to get out of the process and what actions will occur upon the conclusion of the process. The preamble of the Executive Order mandates that the "involvement" of employees and their exclusive representatives is essential to the National Performance Review's reform objectives. The Executive Order also mandates certain actions be taken by the "head of each agency," including "involv[ing] employees and their union representatives as full partners with management representatives to identify problems and craft solutions to better serve the agency's customers and mission."(3)

The Executive Order, however, does not define the term "involvement" nor does the Executive Order establish at what stage of the decision-making process this "involvement" should occur or how this "involvement" should be accomplished. Rather, these matters are left for the parties, through their partnership councils, to deliberate and decide. In Part IV, I will set forth a model of pre-decisional involvement that the Office of the General Counsel has developed in working with parties under the Executive Order. First, however, it is imperative that both parties realize that pre-decisional involvement is in their best interest, not just because the Executive Order mandates "involvement" in identifying problems and crafting solutions, but because it makes sense as a means to accomplish the agency's mission and is essential to transform agencies into organizations "capable of delivering the highest quality service to the American people."(4)

Management decisions on how work should be performed must be implemented - and it is employees who perform those work tasks. Those employees have valuable suggestions on such matters as ways to work better and cost less, achieve significant results for the

money spent, provide value to customers and stakeholders, deliver products and services on time, bring recognition to the agency for the services it provides and foster a productive and constructive labor-management relationship.(5) When those employees are in bargaining units under the Statute exclusively represented by a labor organization which was chosen in a secret ballot election to represent the interests of those employees in workplace matters, pre-decisional involvement proves the means to tap into those employees' extensive hands-on experience. Thus, parties should recognize the potential benefits of a pre-decisional involvement process before they embark on the commitment of time and resources. Similarly, parties also should be aware of the potential risk of engaging in pre-decisional involvement when making these decisions. Listed below are some of those benefits and risks.

Benefits of Pre-Decisional Involvement

1. Better decisions. Employees who do the work have input into the decision-making process and are allowed to present and explore solutions that may have otherwise gone unnoticed.
2. Fuller implementation of decisions. The decision is supported and employees responsible for carrying out directives and performing the work have an ownership stake in the success of those decisions since their interests have been acknowledged and satisfied.
3. Greater support of the decision. Decisions are better understood, both as to their origin and their intent, by those who are charged with implementing the decisions.
4. More timely implementation. The risk of delay in implementation caused by attempts to impede or delay implementation of perceived poor decisions is greatly reduced.
5. Any subsequent collective bargaining will be facilitated. If there is a need to engage in collective bargaining under the Statute after the pre-decisional involvement process, it is highly likely that the parties have narrowed the issues, better understand the others' interests and preferred options and have built more trust in their dealings with each other which will only facilitate the collective bargaining process.(6)

Risks of Pre-Decisional Involvement

1. Increased investment of time. It normally takes longer to reach a decision when an additional entity (the union) and additional participants (employees) are part of the process formulating that decision. Although the decision may be better and implementation may be faster and fuller, the process leading to the decision may take longer.
2. Increased administrative costs. If the participants in the process are not located in the same city, for example, there will be travel costs.

3. Collective bargaining under the Statute may still be necessary. If the interests of the employees that the union represents are not satisfied to the extent necessary, the union may still request to engage in collective bargaining under the Statute. Absent agreement otherwise, the agency normally may not implement a change until that collective bargaining has concluded.

Pre-decisional involvement is a means to better decisions which are timely and fully implemented with the intended results. It is not an end in and of itself. Rather, it is a tool or method to achieve a goal which is in the interests of employees, labor organizations and agencies, the delivery of the "highest quality services to the American people." (7) The participants, in essence, act as a team of problem-solvers working together to find solutions rather than as adversarial negotiators. Pre-decisional involvement processes currently in effect which do achieve success, need to be continued and expanded to all levels within the agency and the labor organization so that it becomes part of the culture as to how labor and management deal with each other on a day-to-day basis. Pre-decisional involvement processes in effect which do not result in better decisions, and which do result in delay, cost and litigation and a worsening of labor-management relationships need to be reevaluated and rethought by the parties. Parties should not attempt to structure a pre-decisional involvement process without an understanding as to how that process will meet their interests.

Parties also should not begin to structure their pre-decisional involvement process until they come to an understanding of the relationship between the pre-decisional involvement process and the duty to bargain under the Statute. The next part explores that relationship.

PART III - THE RELATIONSHIP BETWEEN PRE-DECISIONAL INVOLVEMENT AND THE STATUTORY DUTY TO BARGAIN - "WHAT MUST BE DECIDED BEFORE YOU BEGIN ABOUT WHAT YOU WILL DO AFTER IT IS DONE"

Prior to engaging in a pre-decisional involvement process, the parties should have a common understanding of the relationship between their pre-decisional involvement process and collective bargaining under the Statute. The following are alternatives which may occur after pre-decisional involvement has been completed:

1. Recommendation accepted. The union and agency decision-makers accept the option(s) presented by the team and there is no need for statutory bargaining.
2. Recommendation modified and accepted. The union and agency decision-makers modify the option(s) presented by the team and there is no need for statutory bargaining.
3. Statutory bargaining required. The union and agency decision-makers accept some of the options presented by the team and engage in statutory bargaining limited to the few areas where the team options were not accepted as presented or modified.

- Under this alternative, the parties may establish an expedited bargaining schedule since the interests already have been identified and explained and standards for the solution have been established.
- Under this alternative, since the parties already have a full understanding of the issue, the interests and the extent to which the team proposed options meet and do not meet those interests, the parties may agree to post-implementation bargaining or to partial implementation on those matters where there is no disagreement.

Neither party waives its rights under the Statute by agreeing to engage in pre-decisional involvement. As discussed in Part I, successful pre-decisional involvement may obviate the need for other bargaining under the Statute, or may facilitate any bargaining that is required at the conclusion of the pre-decisional involvement process. The decision to engage in a pre-decisional involvement process does not disadvantage the agency or the union with respect to any statutory rights.

Both parties, however, should fully recognize the possibility that it may indeed be necessary to engage in some statutory bargaining after pre-decisional involvement and prior to implementation of a change which otherwise triggers a duty to bargain under the Statute. Our experience has shown that some parties create conflict when they do not have a common understanding of this concept. For example, an agency may believe that the pre-decisional involvement process fulfilled its statutory bargaining obligation while the union may be under the belief that since it did not fully endorse the final decision, it still had the right to engage in bargaining under the Statute. Improved communication and the articulation of what will occur after the pre-decisional involvement process concludes is essential to avoid this type of conflict.

In working with the parties, my office frequently hears the parties question why engage in pre-decisional involvement if it is not guaranteed to replace bargaining under the Statute. The benefits of pre-decisional involvement were addressed in Part III - better decisions, faster and full implementation, and less conflict. Seldom do both parties agree that they will be bound by any recommendation that is generated by a team or work group as part of a pre-decisional involvement process. Just as the union will seldom commit at the initiation of the process to adopt the final work product which emanates from a pre-decisional team or work group and waive its right to bargain, agencies likewise seldom commit to accept that final work product without some form of higher level agency review, with the potential for modifications from the ultimate agency decision-maker. It is not necessary that either party waive any statutory rights in order to engage in meaningful pre-decisional involvement. If the parties fully implement the model discussed in Part IV; i.e., recognize and articulate their respective interests and set forth the standards which any solution must meet, there is a high possibility that the team members will be able to produce options which provide the basis for the best solution. The process breaks down only when those interests are not identified and explained at the beginning of the process and the team does not understand its role.

Once these initial understandings are achieved, the parties may then begin to explore how they will work together to design and implement a pre-decisional involvement process.

PART IV. THE USE OF INTEREST-BASED PRINCIPLES AND TEAMS TO ACCOMPLISH PRE-DECISIONAL INVOLVEMENT - A MODEL ON WHEN AND HOW TO DO IT

A previous Guidance Memorandum issued by my Office, "The Duty to Bargain Over Programs Establishing Employee Involvement and Statutory Obligations When Selecting Employees for Work Groups" (August 8, 1995), focuses primarily on legal issues inherent in the establishment of work groups. The Guidance discusses such legal issues as the rights and obligations under the Statute when establishing and implementing a program which creates work groups to involve employees in examining ways in which to improve the services provided by the agency; the criteria for selecting employees to participate on work groups and the capacity in which the employees will serve and the consequences which flow from these designations, such as reward and evaluation. I also have provided Guidance to the Regional Directors to assist them when working with the parties in jointly creating a structure for work groups to involve employees in the evaluation and potential redesign of agency operations. Those principles and guidance are equally applicable to the use of a team-based approach grounded in interest-based problem-solving principles to serve as a vehicle for pre-decisional involvement. The instant Guidance will apply those principles to the particular task of creating a process for pre-decisional involvement.

The following is a decisional process which the parties can utilize to develop a vehicle for pre-decisional involvement. Also listed under each step in *italic print* is a model for the parties to consider when developing their own pre-decisional process. The model presented concerns situations where the impetus for engaging in pre-decisional involvement comes from the agency. However, unions may also initiate the exploration of whether pre-decisional involvement should be pursued. The model may equally be used when the union is the moving party. Thus the same factors listed below for agency initiated offers to the union for pre-decisional involvement may also apply to union requests to engage in pre-decisional involvement over issues of concern to the union.

The model follows these basic significant events.

Step 1 - Deciding Whether to Engage in Pre-Decisional Bargaining

Step 2 - Deciding on the Relationship Between the Pre-Decisional Involvement Process and the Statutory Duty to Bargain

Step 3 - Structuring the Pre-Decisional Involvement Process

Step 4 - Recognizing Interests and Deciding on Standards

Step 5 - Creating the Work Team's Charge

Step 6 - The Work Team Decides How It Will Operate and Crafts Solutions to the Issues

Step 7 - The Decision is Made

STEP 1. THE AGENCY AND THE UNION DETERMINE IF THEY WILL ENGAGE IN PRE-DECISIONAL INVOLVEMENT OVER A PARTICULAR MATTER

The Agency Initially Decides if it Will Afford the Union the Opportunity To Engage in a Pre-Decisional Involvement Process

The agency develops factors to determine which topics trigger the opportunity for pre-decisional involvement. These are some examples of factors which have been developed by parties who have worked with the Office of the General Counsel and are presented here for agencies to consider:

- Whether pre-decisional involvement adds value to the decision-making process.
- Whether the issue lends itself to joint management and union concerns and/or opportunities.
- Whether the issue presents an opportunity for the agency and the union to join together to present a common strategy to deal with an external threat.
- Whether the agency already has taken a fixed position on the issue or whether the agency is willing to explore different solutions.
- Whether the issue lends itself to a short term or long term solution, or both.
- Whether the issue lends itself to a local or national solution.

The Agency Transmits Adequate Information to the Union

The agency and union agree upon the type of information that will adequately allow the union to determine if it wishes to engage in pre-decisional involvement process. These are some examples of the types of information transmitted by the agency to the union which have been developed by parties who have worked with the Office of the General Counsel and are presented here for agencies and unions to consider:

- The specific issue(s) involved.
- Any actions that the agency already may have taken on seeking a solution to the issue.
- Any other matters that the agency already may have decided related to the issue.
- Whether the agency has an initial inclination as to the direction that the solution should take.

- Identification of the driving force behind the issue; i.e., why it is an issue in the first instance.
- The agency's initial perspective on how important this issue is to unit employees' conditions of employment and how employees perform their work.
- The degree of confidentiality that is required concerning the identification of the issue itself and of the information which is being provided to the union by the agency.
- Any time frames that the agency already may have established for the decision-making and implementation process.
- The anticipated time that representatives designated by the union will spend in the pre-decisional involvement process.
- The time frame in which the agency expects the union to respond to the invitation to engage in pre-decisional involvement.
- Whether the union may request a briefing or further documentation prior to deciding whether it will engage in pre-decisional involvement.
- The agency contact person on the issue.

The Union Determines If it Will Participate in a Pre-Decisional Involvement Process

The union develops factors to determine whether it will accept the agency's offer to engage in pre-decisional involvement. These are some factors which have been developed by parties who have worked with the Office of the General Counsel and are presented here for unions to consider:

- The impact of the issues on unit employees' conditions of employment and how employees perform their work.
- Whether, and to what extent, the agency already has decided certain matters relating to the initiative.
- The availability of the union's resources.
- The time frames that the agency or some outside entity already has established for the decision-making and implementation process.
- The extent to which the agency is open for alternative solutions.
- Whether the driving force behind the initiative is internal within the agency or external.

STEP 2. REPRESENTATIVES OF THE AGENCY AND THE UNION COME TO A COMMON UNDERSTANDING ON THE RELATIONSHIP BETWEEN THE PRE-DECISIONAL INVOLVEMENT PROCESS AND THE STATUTORY DUTY TO BARGAIN.

The agency and union leadership should have the same common understanding about whether the parties will or not will not engage in collective bargaining under the Statute upon the conclusion of the pre-decisional involvement process and the factors that will influence that determination.(8) The parties also should agree on the consequences if the union chooses not to engage in pre-decisional involvement. For example, the agency may still opt at a latter date to circulate a draft solution which may have been developed on the initiative without union involvement, and/or invite the union to a meeting to discuss developments that have occurred on the issue since the union was initially notified. The parties should acknowledge that whatever action is taken, the union retains its right to negotiate under the Statute and the agency retains its right under section 7106 of the Statute to make and implement decisions.

STEP 3. THE AGENCY AND THE UNION (AND ANY OTHER ENTITIES INVOLVED IN THE PROCESS) COME TO A COMMON UNDERSTANDING ON THE STRUCTURE OF THEIR PRE-DECISIONAL INVOLVEMENT PROCESS.

Identification of Who Determines the Structure of the Pre-Decisional Process

Representatives of the agency and the union make these process decisions. Where the agency and union have a partnership, the partnership council could make these decisions. If there is no partnership, agency and union representatives, or simply one agency leader and one union official, could make these decisions. For purposes of this model, I will refer to the agency/union partnership council as the agency and union representatives.

Partnership Council Model

In this model, the partnership council engages in the decision-making process, while teams selected by the partnership council are charged with brainstorming solutions and analyzing the extent to which various options meet the interests and standards that have been identified by the partnership council. This model allows the agency and the union to ensure that their institutional interests have been identified and met and that the process was fair and the team members were not co-opted. The partnership council may modify the options presented by the team. The partnership council also may request further efforts from the team consistent with the concerns of the partnership council. The partnership council informs the team of the final partnership council action and its rationale. The ultimate decision maker may be the partnership council itself, or, if that authority has not been delegated by the agency to the partnership council, by the appropriate high level agency official with responsibility for the issue.

Additional Option- Final Decision-Making is Delegated to the Team

Another option is to delegate the decision-making authority to the team. Under this option, it is critical that the partnership council ensure that the team members understand the institutional interests of the agency and the union. As discussed in the next step, in addition to the identification of interests by the partnership council, the team members identify any independent interests they have which may not have been recognized by the partnership council before they begin crafting a solution to the issue they have been delegated to resolve.

Additional Option - Other Entities May also Be Involved

This model also provides for the possibility that the agency and the union may agree that entities, other than management and the exclusive representative, have representation on the partnership council and the team. For example, the parties may agree to allow representatives from mid-level management to serve on the partnership council and the team.

STEP 4. THE PARTNERSHIP COUNCIL IDENTIFIES THE INTERESTS OF THE AGENCY AND UNION THAT MUST BE SATISFIED BY THE TEAM'S RECOMMENDATIONS AND THE STANDARDS WITH WHICH ANY SOLUTION MUST BE CONSISTENT.

Partnership Council Develops Agency and Union Interests After Involving Their Constituents

The partnership council develops the interests of the agency and the union that must be satisfied by any proposed solution. It is critical for the leadership of the agency and the union to fully develop their entity's interests. The union should afford bargaining unit employees the opportunity to express their interests and the agency executives should afford their managers at other levels and in the field the opportunity to express their interests. The union and agency leadership can then thoughtfully establish the interests that any solution must satisfy. Similarly, if another entity is allowed to participate, the other entity's institutional interests also are presented and explained to the team members, just as the union's and agency's interests are articulated to the team members.

This model allows the parties to ensure that their institutional interests have been identified. The team members represent the entity that selects them as team members. This entity also is represented on the partnership council. Thus, employees selected by the exclusive representative represent the interests of the union and the bargaining unit.⁽⁹⁾ Managers selected by the agency represent the respective interests of that portion of the agency for which they were selected. Thus, under this model, the team members do not serve as "independent operators," but rather represent broader interests of the team they represent, and those interests are presented and explained by the individuals responsible for leading that entity; i.e., elected union officials and senior agency executives. Under this approach, the potential for the team to develop options which do not address the

institutional interests of the entities involved (the union and the agency), and the associated lost efforts and potential for conflict between the team and the partnership council or ultimate decision maker is greatly reduced.

Additional Option- Team Members Also Identify Independent Interests

In addition to the identification of interests by the partnership council, an option under this model is to provide the team members with the opportunity to also identify any independent interests they have which may not have been recognized by the partnership council. This added option ensures that the team members which have been charged with developing the solution are full participants in the complete process. This additional opportunity takes full advantage of the team members' on-the-job, local expertise, encourages local initiatives and develops ownership by the team members who are being requested not only to develop a proposed solution to meet the agency's and union's institutional needs but also which meets their needs as the employees who will ultimately implement any decision.

The Partnership Council Also Identifies the Standards with Which Any Team Recommendations must Be Consistent

The partnership council also establishes the standards that the team will apply in adopting a recommended solution. These standards are the external restraints that are imposed on any final decision; for example, the solution is legal and must not exceed a specific cost.

STEP 5. THE PARTNERSHIP COUNCIL CREATES THE CHARGE OF THE TEAM AND MEETS WITH THE TEAM TO DISCUSS THE CHARGE.

Partnership Council Creates the Team's Charge

The partnership council, or a subgroup of the partnership council, decides upon the charge of the group. The charge includes partnership council decisions on such matters as:

- The issue to be addressed by the team - the problems, opportunities, issues or subject matter that the team is being asked to address.
- The agency's and the union's interests in those issues and the standards which the solution(s) must meet (see discussion in Step 4).
- The team's decision-making authority. For example, whether the team has final decision making authority or whether the team is to present one or more options to the partnership council and the format for that presentation.
- The limitations, if any, that are placed on the matters which the team can explore. For example, whether any specific topics or options outside the team's charge and what, if anything, is "off" the table.
- The time limitations on the team.

- The relationship between the team members' participation in the pre-decisional involvement process and their other assigned duties and functions.
- The time commitment that will be necessary from each of the team members.
- The size of the team.
- The composition of the team. For example, recognition of what entity is represented by the different members of the team represent - headquarters management, regional management, the union, themselves, employees in their division.
- How the team members will be chosen for inclusion on the team.
- The consequences that flow from those roles. For example, employees representing the union are engaged in protected union activity and employees serving through the assignment of work are not engaged in protected union activity.
- The method and frequency of communication that is expected between the team and the partnership council. For example, whether the team will issue a status or progress report?
- The team's final work product, whether it will be a written report, oral presentation, one recommendation per issue, alternative recommendations, ranked recommendations, and/or recommendations evaluated in certain pre-established standards and interests.
- The information that will be supplied to the team members.
- Whether there will be any technical experts on the team serving pursuant to the assignment of work rather representing the agency, union or other entity.

This model also provides for subject matter experts to be selected by the agency, or jointly by the agency and the union, to serve as technical experts. These subject matter experts may be managers, unit employees who are union members, unit employees who are not union members or unrepresented employees. These technical experts are not serving as union or agency representatives, but rather are serving on the team pursuant to the assignment of work.(10)

Partnership Council Meets with the Team to Present and Discuss the Charge

The partnership council ensures that all members of the team fully understand the process, the issue, the standards and the interests of all the entities represented on the partnership council and their charge. The team members share an understanding of the items in their charge and request clarification of any matters in the charge if necessary.

STEP 6. THE PRE-DECISIONAL INVOLVEMENT TEAM REAFFIRMS A COMMON UNDERSTANDING AMONG ALL TEAM MEMBERS OF THEIR CHARGE AND FULFILLS ITS CHARGE

The Team Reaffirms Its Charge and Decides How It Will Operate

Prior to tackling the substantive task of crafting solutions to workplace issue, the team reaffirms that all team members understand their charge and decides how the team will operate. In addition to the charge, some matters that the team may discuss include:

- Expectations of what they want to collectively accomplish as the work product of their team activities.
- Expectations about the results for which the team members are collectively responsible.
- The limitations, if any, on their activities as to time commitments, resources and matters "off the table."
- What occurs if the ultimate decision maker does not accept the team's recommendations or work product? For example, whether the ultimate decision maker return the recommendations to the team for further action or implements decisions not recommended by the team without further team involvement.
- Each team member's commitment to utilize interest-based principles and an interest-based approach in performing their tasks.
- The commitment of the team members to the process agreed upon.
- Additional information and resources that the team requires.
- The degree of confidentiality, if any, to the team's activities.
- The format of the team's final product.
- Whether the team members possess the requisite skills to accomplish the charge.
- Whether the team members need any specific training prior to beginning their activities.
- Whether the team will establish its own action plan pursuant to the time limits in the charge, with incremental time targets.
- Whether the team will adopt ground rules. For example, whether there will be ground rules on such matters as what happens if a member misses a meeting or leaves a meeting early.

- How the team makes its decisions. The process to be followed if the team cannot reach a decision under that process or if the team gets "stuck."
- How the team will operate. For example, whether there be a team leader, and if so, team leader responsibilities. Who will be responsible for coordinating logistics for meetings, obtaining necessary facilities, services and supplies, disseminating information?
- Whether there will be a facilitator - either from within or outside the team, and the facilitator's role.

Additional Option - The Team Members Identify Their Individual Interests Not Recognized by the Partnership Council

As discussed in Step 4, in addition to recognition of the agency's and union's interests, this model provides an option for individual team members to also identify any independent interests they have which may not have been recognized by the partnership council. If this additional opportunity to identify interests is chosen, it should be undertaken by the team before the team begins to brainstorm potential solutions.

The Team Engages in Brainstorming to Develop Options to Resolve the Issue in its Charge

After achieving clarity of the issue and its charge, an understanding of all the interests being represented and the standards established by the partnership council before the team was formed, the team members, including any technical experts, engage in brainstorming. The team members understand the standards and the interests and are able to develop options which are consistent with those standards and satisfy those interests.

The Pre-Decisional Involvement Team Evaluates the Extent to Which Various Options May Meet the Recognized Interests in a Manner That Is Consistent with the Previously Established Standards and Prepares its Work Product for Submission to the Partnership Council

Unless the team is delegated the authority to make the final decision on the subject, the team will be charged with presenting options to the ultimate decision maker, usually either the partnership council or the senior agency official. The recommended options are consistent with the standards and best meet the interests of all entities represented on the team, and the individual team members if that option was selected, that were articulated prior to the commencement of the team's efforts. The team provides a written report which analyzes how each of the recommended options meet the interests which had been expressed and the extent to which it meets those interests. The team also has the option to prioritize options, based on the team's collective assessment of the extent to which a solution meets the interests and is consistent with the criteria. If the team cannot reach consensus on prioritizing options, the report details the extent to which each supported option satisfies, and does not satisfy, the various interests represented on the team. The

technical experts participate as subject matter resources during this evaluation process, but do not participate as a principle of the team in determining the prioritization of the options.

This model allows the team members to focus their energies on the development of solutions to the issue. Our experience has shown that there is a possibility that both local union and agency managers may not fully know or understand the interests of their principals. In such situations, the team's efforts are not as productive as they could be since the team spends time developing a solution which does not meet their principals' needs. Rejection of recommendations by the team alienates the team members, both union and agency, and may result in delay, and worst, conflict between the team and the decision maker(s).

If the individual team members are afforded the opportunity to present their own individual interests that weren't recognized in their charge by the partnership council, those interests also will be addressed in the solution. Whether or not individual interests are recognized, however, any proposed solution must meet the interests developed by the partnership council.

In addition, this model removes the decision-making task from the team, but allows the team members to use their skills, knowledge and abilities to perform the task for which they were chosen - to develop solutions to issues. This model sets the stage at the beginning so that the team members recognize and understand their role as brainstorming options that are consistent with previously established standards, and to meet the fully articulated interests of all the entities involved in the process. The team members engage in evaluation of the options and are encouraged to prioritize the options based on the extent to which the options satisfy the interests of the all parties.

STEP 7. THE PARTNERSHIP COUNCIL REVIEWS THE TEAM'S WORK PRODUCT AND TAKES APPROPRIATE ACTION.

The team presents its report to the partnership council pursuant to the team's charge. The partnership council reviews the team's work product, particularly the reasons given as to the extent certain recommendations do or do not satisfy the various interests that were explained to the team members by the partnership council. The partnership council has the option to return the work product to the team with further instructions or to clarify certain questions raised by the partnership council. The partnership council, if authorized to do so, may also choose to accept or modify the options or create a new option to recommend to the ultimate decision maker, if the partnership council itself has not been granted that authority. The partnership council reports its action to the team, regardless of the action taken.

Our experience has shown that most team recommendations are usually modified by the ultimate decision maker(s) prior to acceptance. Sometimes, the team members are not even consulted about any changes or the reasons therefore, leaving the members with an unfulfilling experience. This approach allows the team to focus its skills, knowledge and

abilities on developing solutions while allowing the leaders of the entities involved in the process to engage in the final decision-making.

Attached to this Guidance is a summary of this model for the Regions to use when assisting the parties in designing a pre-decisional involvement process. The model relies upon a pre-decisional process based on interest-based principles, rather than an approach where the participants come to meetings to present their positions and attempt to convince the other members to agree with those positions and modify their own positions. The experience of the Office of the General Counsel in working with parties under our FITE Policy has revealed that an interest-based approach to problem solving is a far more effective tool to obtain meaningful solutions to workplace issue. Accordingly, consistent with the mandate in the Executive Order that interest-based bargaining should be used as a tool to deliver the highest quality services to the American taxpayer, this Guidance has set forth a model for the use of interest-based problem solving by a team charged with developing solutions to work place issues in a pre-decisional setting.(11)

A GUIDE TO DESIGNING A PRE-DECISIONAL INVOLVEMENT PROCESS

GROUP	STEP	ACTION
Agency Executives and Union Leadership	1	The Agency and the Union Determine if They Will Engage in Pre-Decisional Involvement Over a Particular Matter.
Agency and Union Representatives	2	Representatives of the Agency and the Union Come to a Common Understanding on the Relationship Between the Pre-Decisional Involvement Process and the Statutory Duty to Bargain.
Partnership Council	3	The Agency and the Union (and any Other Entities Involved in the Process) Come to a Common Understanding on the Structure of Their Pre-decisional Involvement Process.
Partnership Council	4	The Partnership Council Identifies the Interests of the Agency and Union That Must be Satisfied by the Team's Recommendations and the Standards With Which any Solution Must be Consistent.
Partnership Council	5	The Partnership Council Creates the Charge of the Team and Meets with the Team to Discuss the Charge.
Pre-Decisional Involvement Team	6	The Pre-Decisional Involvement Team Meets and Reaffirms a Common Understanding Among All Team Members of their Charge and Fulfills Its Charge.
Partnership Council	7	The Partnership Council Reviews the Team's Work Product and Takes Appropriate Action.

Footnotes follow:

1. Previous public guidance memoranda have been issued on "The Duty to Bargain Over Programs Establishing Employee Involvement and Statutory Obligations When Selecting Employees for Work Groups" (August 8, 1995), "Guidance on Investigating, Deciding and Resolving Information Disputes" (January 5, 1996), "The Duty of Fair Representation" (January 27, 1997), and "The Impact of Collective Bargaining Agreements on the Duty to Bargain and the Exercise of Other Statutory Rights" (March 5, 1997).

2. Executive Order 12871, as amended.
3. Executive Order 12871, as amended, Section 2 (b). The Executive Order also, among other things, establishes the National Partnership Council (Section 1), and mandates agency heads to create labor-management partnerships at appropriate levels, provide systematic training of agency employees in "consensual methods of dispute resolution, such as alternative dispute resolution techniques and interest-based bargaining approaches," negotiate over subjects within section 7106(b)(1) of the Statute and evaluate progress and improvements in organizational performance resulting from labor-management partnerships. (Section 2 (a), (c), (d) and (e).)
4. Executive Order 12871, as amended.
5. This is the "recipe" for a "high performing Federal Agency" developed by working groups of the National Partnership Council and the Human Resource Development Council. Training and Facilitation Handbook, National Partnership Council, April 1996, at 4.
6. In Part III, I will explore the relationship between pre-decisional involvement and the duty to bargain under the Statute.
7. Executive Order 12871, as amended, at Preamble.
8. Part III explored the relationship between pre-decisional involvement and collective bargaining under the Statute.
9. These employees are engaged in protected activity and are serving as union representatives on the team. Accordingly, as discussed in the August 8, 1995 Guidance Memorandum on Work Groups, they may not be evaluated on their performance on the team. Further, since these employees are serving as union representatives, the union may consider union membership as a criterion in selecting its representatives, although the union is not required to do so.
10. As such, the technical experts are not engaged in protected activity under the Statute and thus they may be evaluated on their performance, either positively or negatively, and they may be rewarded for their participation and contributions.
11. This model is only one possibility. The Regions should assist the parties in using an interest-based problem-solving approach to create their own model or adapt this model to satisfy their specific interests.

EXECUTIVE SUMMARY

FLRA GENERAL COUNSEL JOSEPH SWERDZEWSKI'S MEMORANDUM TO REGIONAL DIRECTORS ON "PRE-DECISIONAL INVOLVEMENT: A TEAM-BASED APPROACH UTILIZING INTEREST-BASED PROBLEM SOLVING PRINCIPLES"

This Executive Summary of the Federal Labor Relations Authority, General Counsel's Guidance Memorandum to the Regional Directors discusses the concept of "pre-decisional involvement" and its implementation utilizing a team-based approach which relies upon interest-based problem solving skills, techniques and strategies.

The Memorandum serves as guidance to the Regional Directors in educating the parties on the benefits of collaborative approaches to labor-management relations and in assisting them in their efforts to improve those relationships. The Guidance also implements the Office of the General Counsel Facilitation, Intervention, Training and Education Policy (FITE) which sets forth the principles and criteria that the Office of the General Counsel follows when working with the parties and delivering FITE activities to further the development of collaborative relationships and dispute resolution.

The Guidance Memorandum is divided into four parts which address the concept of pre-decisional involvement and what it is and where it comes from? (Part I), the benefits of engaging in pre-decisional involvement - why do it? (Part II), the relationship between pre-decisional involvement and the statutory duty to bargain - what must be decided before you begin about what you will do after it is done? (Part III), and the use of interest-based principles and teams to accomplish pre-decisional involvement - a model on when and how to do it (Part IV). Attached to this Guidance is a step-by-step approach for the Regions to use when assisting the parties in designing a pre-decisional involvement process. The Guidance Memorandum and this Executive Summary reflect the views of the General Counsel and do not constitute an interpretation by the Authority Members.

ATTACHMENT

PART I

WHAT IS PRE-DECISIONAL INVOLVEMENT AND WHERE DID IT COME FROM?

Q. #1: What is "pre-decisional involvement?"

Simply stated, "pre-decisional involvement" is a term which represents those activities where employees through their elected exclusive representative are afforded by agency management the opportunity to shape decisions in the workplace which impact on the work the employees perform.

Q. #2: Where did this concept originate?

The preamble of the Executive Order provides that "[t]he involvement of Federal Government employees and their union representatives is essential to achieving the National Performance Review's Government reform objectives." Pre-decisional involvement is a vehicle that provides for that "involvement."

Q. #3: Is pre-decisional involvement important to collaborative labor-management relations?

In the General Counsel's view, pre-decisional involvement is the cornerstone of Executive Order 12871, as amended, "Labor-Management Partnerships."

Q. #4: Does pre-decisional involvement expand the number of subjects over which there is a duty to bargain under the Federal Service Labor-Management Relations Statute (Statute)?

No. It does not expand the topics which are mandatorily negotiable under the Statute.

Q. #5: Does pre-decisional involvement require either the union or the agency to waive or give up any rights under the Statute?

No. Pre-decisional involvement does not waive management's statutory right to make decisions under section 7106 of the Statute, nor does it waive a labor organization's right to engage in bargaining prior to implementation to the extent required by the Statute.

Q. #6: What does pre-decisional involvement provide for?

It represents a process where unit employees who perform the daily tasks that collectively accomplish the mission of the agency have input into a decision-making process in order "to design and implement comprehensive changes necessary to reform Government" and "to champion change in Federal Government agencies to transform them into

organizations capable of delivering the highest quality service to the American people, as expressed in the Executive Order."

Q. #7: What prerequisites do the agency and union have to meet before embarking on a pre-decisional involvement process?

In order to be successful, it is critical that both parties to the relationship, labor and management:

- have a common understanding of what pre-decisional involvement, as they themselves define it, means;
- share a mutual appreciation of why it is in their own best interest to engage in pre-decisional involvement;
- have similar expectations of the results they seek to obtain from pre-decisional involvement; and
- agree on what actions occur after pre-decisional involvement has concluded.

Q. #8: What are the basic principles underlying the concept of pre-decisional involvement?

These are the basic principles of pre-decisional involvement:

- The process begins early when ideas are forming;
- The parties have common expectations;
- Information is freely shared throughout the process and there is an understanding on confidentiality of the information and the process;
- The participants utilize a problem solving approach founded on interest-based principles;
- The participants adapt a team approach to their activities; and
- The parties and the participants demonstrate a high degree of commitment to the process and to achieving their shared expectations.

PART II

THE BENEFITS OF ENGAGING IN PRE-DECISIONAL INVOLVEMENT - WHY DO IT?

Q. #1: Should a party engage in pre-decisional involvement just because it is "the thing to do?"

No. No party should engage in pre-decisional involvement unless that party believes that it is in its interest to do so. No party should engage in pre-decisional involvement unless it has willingly participated in a process to develop exactly what pre-decisional means, how it will be accomplished, what the parties hope to get out of the process and what actions will occur upon the conclusion of the process.

Q. #2: Then why should a party engage in pre-decisional involvement?

Because it makes sense as a means to accomplish the agency's mission and it is essential to transform agencies into organizations "capable of delivering the highest quality service to the American people," as envisioned by the Executive Order and the National Performance Review.

Q. #3: Does the Executive Order explain how the parties should "involve employees and their union representatives as full partners with management representatives to identify problems and craft solutions to better serve the agency's customers and mission?"

No. The Executive Order, however, does not define the term "involvement" nor does the Executive Order establish at what stage of the decision-making process this "involvement" should occur or how this "involvement" should be accomplished.

Q. #4: Who then decides these critical issues?

These matters are left for the parties, through their partnership councils, to deliberate and decide. The Guidance Memorandum sets forth a model of pre-decisional involvement that the Office of the General Counsel has developed in working with parties under the Executive Order.

Q. #5: Why should employees be involved in the decision-making process? Isn't that management's job and responsibility?

The ultimate responsibility for making management decisions rests with management. Management manages the agency and unions represent bargaining unit employees. However, management decisions on how work should be performed must be implemented - and it is employees who perform those work tasks. Those employees have valuable suggestions on such matters as ways to work better and cost less, achieve significant results for the money spent, provide value to customers and stakeholders, deliver products and services on time, bring recognition to the agency for the services it provides and foster a productive and constructive labor-management relationship.

Q. #6: Why is it necessary to deal with the union if it is the employees who have the suggestions?

When employees are in bargaining units under the Statute exclusively represented by a labor organization which was chosen in a secret ballot election to represent the interests of those employees in workplace matters, the union is the means to tap into those employees' extensive hands-on experience.

Q. #7: What are the benefits of pre-decisional involvement?

- Better decisions.

- Fuller implementation of decisions.
- Greater support of the decisions.
- More timely implementation.
- Any subsequent collective bargaining will be facilitated.

Q. #8: What are the risks of pre-decisional involvement?

- Increased investment of time.
- Increased administrative costs.
- Collective bargaining under the Statute may still be necessary.

Q. #9: Is pre-decisional involvement an end in and of itself where "the box needs to be checked?"

No. Pre-decisional involvement is a means to better decisions which are timely and fully implemented with the intended results. It is not an end in and of itself. Rather, it is a tool or method to achieve a goal which is in the interests of employees, labor organizations and agencies, the delivery of the "highest quality services to the American people," as envisioned by the Executive Order.

PART III

THE RELATIONSHIP BETWEEN PRE-DECISIONAL INVOLVEMENT AND THE STATUTORY DUTY TO BARGAIN - WHAT HAPPENS AFTER YOU DO IT?

Q. #1: Does pre-decisional involvement mean that there is no need to bargain afterwards?

Maybe. Successful pre-decisional involvement may obviate the need for other bargaining under the Statute, or may facilitate any bargaining that is required at the conclusion of the decisional involvement process. But the decision to engage in a pre-decisional involvement process does not disadvantage the agency or the union with respect to any statutory rights.

Q. #2: What alternatives may occur after pre-decisional involvement has been completed?

- Recommendation adopted. The parties accept the option(s) presented by the team and there is no need for statutory bargaining.
- Recommendation modified and accepted. The parties modify the option(s) presented by the team and there is no need for statutory bargaining.
- Statutory bargaining required. The parties accept none or some of the options presented by the team and engage in statutory bargaining limited to the areas where the team options were not accepted as presented or modified.

Q. #3: Is it important that the parties understand that bargaining under the Statute might have to occur after pre-decisional involvement?

It is more than important - it is critical! Both parties should fully recognize the possibility that it may indeed be necessary to engage in some statutory bargaining after pre-decisional involvement and prior to implementation of a change which otherwise triggers a duty to bargain under the Statute. Our experience has shown that conflict can occur when the parties do not have a common understanding of this concept.

Q. #4: Then why should a party, particularly an agency, engage in pre-decisional involvement if it is not guaranteed to replace bargaining under the Statute?

Properly implemented pre-decisional involvement results in better decisions, faster and full implementation, and less conflict, even if bargaining is still required. Seldom do both parties agree that they will be bound by any recommendation that is generated by a team or work group as part of a pre-decisional involvement process. If the parties recognize and articulate their respective interests and set forth the standards which any solution must meet, there is a high possibility that the team members will be able to produce options which provide the basis for the best solution.

Q. #5: Is the pre-decisional process a barrier or facilitator of the bargaining that must still take place?

If properly implemented, pre-decisional involvement serves to assist the subsequent bargaining process. Since the parties already have a full understanding of the issue, their respective interests, and the extent to which the team proposed options meet those interests, they may agree to post-implementation bargaining, or to partial implementation on those matters where there is no disagreement, or to an expedited bargaining schedule.

PART IV

THE USE OF INTEREST-BASED PRINCIPLES AND TEAMS TO ACCOMPLISH PRE-DECISIONAL INVOLVEMENT - A MODEL ON WHEN AND HOW TO DO IT

Q. #1: What are the initial matters that should be agreed upon by the parties to determine whether pre-decisional involvement is appropriate?

The parties should come to a common understanding on the following matters:

- The issues or types of issues that are appropriate for pre-decisional involvement.
- The information that the agency will provide to the union when the pre-decisional involvement process is triggered.
- The factors that the union will evaluate to determine whether it will engage in pre-decisional involvement.
- The range of options for the union to choose from in determining whether to engage in pre-decisional involvement.
- The consequences of a union decision not to engage in pre-decisional involvement.

- Circumstances which allow the union to initiate the pre-decisional involvement process.

Q. #2: What are some of the basic issues that the parties must address in structuring a pre-decisional involvement process?

The parties participating in the pre-decisional process should jointly reach a common understanding on such matters as the charge, size and membership of the team, the role of team members, what matters are "off the table," time limitations, time commitment, format of the final work product, information needed, and the decision-making process. These general topics are more fully developed in the Guidance Memorandum.

Q. #3: What are some of the basic issues that the team members must address before the team begins operation?

The team members should have a common understanding on such general matters as the scope of their charge, expectations, limitations, decision-making process, standards and interests that any solution must meet, method of team operation, commitment to the task, information and resources needed, format of final work product, confidentiality and skills needed. These general topics also are more fully developed in the Guidance Memorandum.

Q. #4: How can the parties apply interest-based principles to a pre-decisional team-based process?

The Guidance sets forth one model for the use of interest-based problem solving by a team charged with developing solutions to workplace issues in a pre-decisional setting. In sum, the model utilizes teams which are charged with brainstorming solutions and analyzing the extent to which various options meet the interests and standards that have been identified by a partnership council composed of the leadership of the entities that have agreed to utilize a pre-decisional process. The model also provides for individual team members to present their independent interests that may not have been recognized by the partnership council.

Q. #5: Can you practice pre-decisional involvement if you do not have a partnership council?

Yes. This model provides for union and agency leaders, plus any other entity that is participating (such as a mid or executive level manager's group) to serve as decision-makers. These leaders normally would comprise a partnership council where one existed.

Q. #6: What is the role of the partnership council?

The partnership council decides the matters described above in question # 2. In particular, the partnership council identifies the issue, drafts the charge, and develops the standards

that any solution developed by the team must meet. Further, each entity participating in the process identifies their interests which must be satisfied by any solution.

Q: #7: Why does the model provide that the standards and interests are developed by the partnership council?

This model allows the parties to ensure that their institutional interests have been identified and will be met by any proposed solutions. Some employees and managers selected to participate on a team may not know or share the institutional interests of their principals. Sometimes, the principals themselves have not given the identification of their interests the proper attention. This model ensures that all institutional interests are identified before the team begins its work and expends its resources.

Q. #8: What is the role of the team?

As noted in question #4, the model also provides an option for individual team members to present their independent interests that may not have been recognized by the partnership council. Whether or not this occurs, the team is charged with brainstorming options to resolve the issue in the charge and evaluating the extent to which various options meet the interests of all of the parties in a manner that is consistent with the previously established standards.

Q. #9: Who do the team members represent?

Under this model, the team members represent the party that selected them for participation on the team. The members are not "independent operators," but represent the often broader interests of the party they represent. All team members are charged with developing options that best meet the previously identified interests of all the parties and which are consistent with the standards developed by the partnership council and any team members if that option is selected.

Q. #10: Who makes the final decision?

In this model, the partnership council engages in the decision-making process. The partnership council may modify the options presented by the team. The ultimate decision maker may be the partnership council itself or, if that authority has not been delegated by the agency, by the appropriate high level agency official with responsibility for the issue. The model also provides for an option to delegate the final decision-making authority to the team.

Q. #11: Does the model provide for subject matter experts?

Yes. This model also provides for subject matter experts to be selected by the agency, or jointly by the agency and the union, to serve as technical experts. These subject matter experts may be managers, unit employees who are union members, unit employees who

are not union members or unrepresented employees. These technical experts are not serving as union or agency representatives, but rather serve on the team as expert advisers pursuant to the assignment of work.

Q. #12: What is the team's final work product?

Any options recommended by the team should be consistent with the standards and the interests articulated by the partnership council prior to the commencement of the team's efforts. A written report could be used to analyze how each of the recommended options meets the interests which had been expressed and the extent to which it meets those interests. The model also allows the team the option to prioritize options, based on the team's collective assessment of the extent to which a solution meets the interests and is consistent with the criteria. If the team cannot reach consensus on prioritizing options, the report details the extent to which each supported option satisfies, and does not satisfy, the various interests represented on the team. The technical experts participate as subject matter resources during this evaluation process, but do not participate as a principal of the team in determining the prioritization of the options.

Q. #13: What are the options for the partnership council when presented with the team's work product?

Unless the team has been delegated final decision-making authority, the partnership council has the option to return the work product to the team with further instructions or to clarify certain questions raised by the partnership council, accept or modify the options, or create a new option to recommend to the ultimate decision-maker, if the partnership council itself has not been granted that authority. The partnership council reports its action to the team, regardless of the action taken.

Q. #14: Why isn't the team under this model always empowered to engage in a final decision-making process?

The team may be delegated final decision-making authority. However, even if no delegation occurs, the team does engage in a decision-making process to the extent that the team evaluates the various options and attempt to prioritize the options based on the extent to which they meet all of the parties' interests and are consistent with the standards. The model allows the team members to focus their energies on the development of solutions to the issue, rather than become entrenched in attempting to reach consensus on one final decision.

Q. #15: Why does the model move the decision-making process to the partnership council?

Our experience has shown that most team recommendations are usually modified by the ultimate decision-maker(s) prior to acceptance. This model enhances the use of time and talents by utilizing the leadership to develop the parameters of any solution (identification

of the issue, the standards and identification of the parties' interests), allowing the team members to use their knowledge skills and abilities and experiences to formulate proposed solutions (brainstorming and evaluation), and providing for final decision-makers by those leaders who are responsible for making decisions (either the steering committee or the ultimate agency decision maker). However, there are also alternatives presented where the team itself can be delegated to be the final decision-maker and where the team members may raise their individual interests that may not have been recognized by the parties.

A GUIDE TO DESIGNING A PRE-DECISIONAL INVOLVEMENT PROCESS

GROUP	STEP	ACTION
Agency Executives and Union Leadership	1	The Agency and the Union Determine if They Will Engage in Pre-Decisional Involvement Over a Particular Matter.
Agency and Union Representatives	2	Representatives of the Agency and the Union Come to a Common Understanding on the Relationship Between the Pre-Decisional Involvement Process and the Statutory Duty to Bargain.
Partnership Council	3	The Agency and the Union (and any Other Entities Involved in the Process) Come to a Common Understanding on the Structure of Their Pre-decisional Involvement Process.
Partnership Council	4	The Partnership Council Identifies the Interests of the Agency and Union That Must be Satisfied by the Team's Recommendations and the Standards With Which any Solution Must be Consistent.
Partnership Council	5	The Partnership Council Creates the Charge of the Team and Meets with the Team to Discuss the Charge.
Pre-Decisional Involvement Team	6	The Pre-Decisional Involvement Team Meets and Reaffirms a Common Understanding Among All Team Members of their Charge and Fulfills Its Charge.
Partnership Council	7	The Partnership Council Reviews the Team's Work Product and Takes Appropriate Action.

Appendix D

Human Factors Activities in the Acquisition Process

Human Factors Tasks in the Acquisition Process¹

1.0 GENERAL HUMAN FACTORS TASKS

1.1 Human factors integration. Integrating human factors in the acquisition and system engineering process is complex because of the scope of the human factors considerations, the pervasiveness of human performance issues, and the difficulty in quantifying performance parameters especially early in the process. However, if given the proper resources and discipline, this process has proven to be successful in lowering lifecycle costs, improving overall system performance, and reducing program technical risks. This human factors engineering process encompasses efforts related to the design, development, manufacturing, procurement, verification, deployment, operations, support, and disposal of system products and processes.

The application of human engineering to hardware systems, software, and facilities to effectively integrate users into the design of the system provides an opportunity to: (1) develop or improve all human interfaces of the system (see Table 1); (2) achieve required effectiveness of human performance during system operation, maintenance, and support; and (3) make economical demands upon personnel resources, skills, training, and costs. The human engineering effort includes active participation in the following major interrelated areas of system acquisition:

1.2 Planning. Human engineering program planning includes the tasks to be performed, human engineering milestones, level of effort, methods to be used, design concepts to be utilized, the test and evaluation program, and implementation considerations in terms of an integrated effort within the total project.

1.3 Analysis. Starting with a mission analysis, continuing through an investment analysis, and developed from a baseline scenario, the functions that must be performed by the system in achieving its mission objectives are identified and described. These functions are analyzed to determine the best alternatives for allocation to personnel, equipment, software, or combinations thereof. Allocated functions are further dissected to define the specific tasks that must be performed to accomplish the functions. Each task is analyzed to determine the human performance parameters; the system, equipment, and software capabilities; and the environmental conditions under which the tasks are conducted. Task parameters are quantified, where possible, and in a form permitting effectiveness studies of the human-system interfaces in relation to the total system operation. The identification of human engineering high-risk areas is initiated as part of the analysis. Analyses are updated as required to remain current with the design effort.

1.4 Design and development. Design and development of the system equipment, software, procedures, work environments, and facilities associated with the system functions requiring personnel interaction should include a human engineering effort. This

¹ Adapted from FAA Human Factors Job Aid and MIL-STD-46855A

human engineering effort converts the mission, system, and task analyses data into: (1) detail design, (2) functions and performance criteria for selection and evaluation of COTS/NDI systems, (3) development plans to create a human-system interface that will operate within human performance capabilities, meet system functional requirements, and accomplish mission objectives.

1.5 Test and evaluation. Test and evaluation are conducted to verify that design of systems, equipment, software, and facilities meets human engineering criteria, can be operated and maintained within the intended users' performance capabilities, and is compatible with the overall system requirements and resource constraints.

1.6 Human factors management and coordination. The management and coordination of human factors program activities is conducted to achieve efficient use of resources and to ensure that results are effective in meeting program objectives. The human engineering program is coordinated with reliability, availability, maintainability, system safety, risk management, facilities engineering, integrated logistic support, and other human factors functions including biomedical, personnel, and training, and is integrated into the total system program. Human engineering data are provided for incorporation into the logistic support analysis data and should utilize logistics support activities' source data where possible.

TABLE 1: HUMAN PERFORMANCE INTERFACES IN SYSTEMS ACQUISITION ²

Human Interface Class	Performance Dimension	Performance Objective
Functional Interfaces: For operations and maintenance - role of the human vs. automation; functions and tasks; manning levels; skills and training	Task performance	Ability to perform tasks within time and accuracy constraints
Information Interfaces: Information media, electronic or hardcopy, information characteristics, and the information itself	Information handling/processing performance	Ability to identify, obtain, integrate, understand, interpret, apply, and disseminate information
Environmental Interfaces: Physical, psychological, and tactical environments	Performance under environmental stress	Ability to perform under adverse environmental stress, including heat/cold, vibration, restrictive clothing, variable illumination, reduced visibility, weather, constrained time, and psychological stress
Operational Interfaces: Procedures, job aids, embedded or organic training and on line help	Sustained performance	Ability to maintain performance over time
Organizational Interfaces: Job design, policies, lines of authority, management structure, and organizational infrastructure	Job performance	Ability to perform jobs, tasks, and functions within the management and organizational structure
Cooperational Interfaces: Communications, interpersonal relations, and team performance	Team performance	Ability to collectively achieve mission objectives
Cognitive Interfaces: Cognitive aspects of human-computer interfaces (HCI), situational awareness, decision making, information integration, and short term memory	Cognitive performance	Ability to perform cognitive operations (e.g., problem solving, decision making, information integration, situational awareness)
Physical Interfaces: Physical aspects of the system with which the human interacts, (e.g., HCI, controls and displays, workstations, and facilities)	Operations and maintenance performance	Ability to perform operations and maintenance at workstations and worksites, and in facilities using controls, displays, equipment, tools, etc.

² Adapted from Carlow International Incorporated

2.0 DETAILED HUMAN FACTORS TASKS

2.1 Human Factors Engineering Program Planning: This section defines the overarching strategy for the planning of a human factors effort in support of acquisition programs. The Human Factors Program establishes the approach for applying human factors engineering to the system being acquired to increase total system performance and reduce developmental and lifecycle costs (especially in the areas of staffing, personnel, operations and training). The Human Factors Program focuses on the human performance produced when the system is operated and maintained in an operational environment by members of the intended target population. The origins of the Human Factors Program occur early in the Mission Analysis and Investment Analysis phaseS of the system acquisition process and are refined during each subsequent acquisition phase, as required.

Establishing a Human Factors Program for a given system acquisition requires a focus on the tasks the users (operators, maintainers, and support personnel) will perform using the system, and the program activities that must be undertaken during the acquisition to allow early identification and resolution of human performance issues. The tasks to be performed in developing the Human Factors Program include:

TASK 1. A Human Factors Coordinator (HFC) is designated to coordinate the Human Factors Program. The HFC develops, directs, and monitors the Human Factors Program and its activities for the system acquisition. The HFC role is to perform, direct, or assist in:

- Defining human factors impacts and constraints during investment analysis and requirements determination
- Identifying human-system interfaces for market surveys, trade-off analyses, and prototypes
- Preparing and updating human factors portions of acquisition documents, procurement packages, performance measures and criteria, and data collection efforts
- Developing and analyzing operational scenarios and human-system modeling (with human-in-the-loop) for operators and maintainers
- Reviewing and assessing human factors concepts and designs
- Coordinating human factors efforts and working group activities
- Coordinating human factors with other disciplines

To facilitate accomplishment of human factors tasks and activities, the HFC may establish and chair a Human Factors Working Group (HFWG). Initial HFC duties may involve devising the recommended HFWG membership and operating procedures for approval. The HFC will ensure that human factors issues are identified and addressed for the system acquisition and that the human factors strategy is formulated and applied. The scope of work and composition of the HFWG is tailored to the needs of the system being acquired. After the contract is awarded, the contractor's Human Factors Engineer

may be appointed as deputy chair of the HFWG.

TASK 2. The concept(s) for how the system will be employed and maintained drives operator and maintainer tasks. Performance standards for these tasks will define the staffing and training requirements. Additional information included here addresses the human performance impacts related to:

- Numbers of systems and configurations to be purchased,
- Location, physical environment, and work space,
- Operational conditions and limitations for the system,
- Operational scenarios, training, and procedures, and
- Maintenance approach and procedures.

TASK 3. The HFC directs the development of a profile that represents the people who will operate, maintain, and support the system. This profile is often called a target population description. The target population is composed of the users (operators, maintainers, and support personnel) for whom the system is designed. Characteristics used to describe this population include numbers of people available, skills, organizational structure, location, training history, aptitudes, and anthropometric data (as appropriate).

TASK 4. The human factors effort focuses on the tasks generated where the human and the system hardware and software interface. The functions that the system will perform are identified along with the human interfaces associated with those system functions. Generally, the predecessor system is a good source for these interfaces and tasks. The predecessor system may also serve as a source of information on those tasks that require additional staffing, skills, or training to perform. These are commonly referred to as high-driver tasks. The Human Factors Program addresses acquiring and applying information to system design to mitigate the impact of these high-driver tasks on the new system. As the system evolves, operations and maintenance tasks are stated in operational terms of time and accuracy of task performance. Measures of effectiveness or performance are devised to verify the system's overall operational performance.

TASK 5. In this task, the potential risks or enhancements to system and human performance that pertain to the operational and maintenance tasks of the system being acquired are identified. Constraints and limitations on human resources are addressed. Some questions that may lead to pertinent issues are:

- Will the new system require additional staffing?
- Will the new system require new skills to operate and maintain the system that do not currently exist in the work force?
- Will the system require the work force to conduct training different from that currently mandated?

- Will the target population user be able to perform to specified levels of safety and productivity?

The identification of issues includes:

- A full description of the issue
- The problem or risk associated with the issue
- The consequence(s) of not resolving the issue
- Steps to be taken to resolve the issue
- Status of the corrective action(s)

TASK 6. Given the number and nature of the issues to be resolved, the HFC identifies the major human factors objectives and what tasks and activities must be accomplished to address the issues and to execute the Human Factors Program. The Human Factors Program tasks and activities constitute the essential elements of a plan for the execution of the human factors effort. Some examples of human factors tasks and activities include:

- Studies and analyses to describe and develop the human and system performance baselines.
- Schedule for coordination and integration activities (such as meetings of the HFWG and analyses to be conducted).
- Prototype development efforts to define and refine the statement of the system requirements.
- Activities supporting human factors in test and evaluation.
- Points during the acquisition process at which Human Factors Program progress will be assessed and refined.

TASK 7. The approach taken to achieve the Human Factors Program objectives will vary with the size, cost, and complexity of the system being acquired. Different strategies are appropriate for non-developmental items (NDI) and commercial-off-the-shelf (COTS) acquisitions as compared to full-developmental efforts. Some systems may need more or different human factors support when focused on requirements definition than on influencing the design during the system engineering process. To accommodate both the number and type of skills needed to support the program during its lifecycle, an overall strategy to acquire the necessary human factors support must be devised.

Consideration also is given to concerns such as:

- The level of support to be rendered by the government versus the contractor,
- The equipment, data sources, and facilities needed,
- The funding and other resources required,
- The schedule for human factors tasks and activities, and
- The relationship with other program developments and requirements.

TASK 8. Because each system acquisition program is unique in its pace, cost, size, complexity, and human interfaces, the Human Factors Program is tailored to meet program demands. As the system progresses through the lifecycle phases of the acquisition process, changes will occur. The Human Factors Program must be structured and maintained to change iteratively with the system. To aid in the management of the Human Factors Program, the HFWG may prepare a management approach document. A recommended format and content for such a document is shown in Table 2.

TABLE 2. HFWG MANAGEMENT DOCUMENT CONTENT AND FORMAT		
	Headings	Content
Background	Program Summary	<ul style="list-style-type: none"> • Brief description of the program • Concept of operation and maintenance
	Program Schedule	<ul style="list-style-type: none"> • Overview of system acquisition schedule
	Target Population	<ul style="list-style-type: none"> • Identify the operator and maintainer • Demographics • Biographical data • Previous training • Aptitudes • Task-related experience • Anthropometric data • Physical qualifications • Organizational relationships • Work space requirements
	Guidance	<ul style="list-style-type: none"> • Summarize any guidance received
	Constraints	<ul style="list-style-type: none"> • State if additional staffing is required by the new system • State whether an existing job series will be used or a new one created • Post limits on the amount of time that can be afforded for training • Establish standards on the working conditions that will be acceptable when the new system is fielded • Limitations imposed by maintenance policy • Requirements as a result of union agreements

TABLE 2. HFWG MANAGEMENT DOCUMENT CONTENT AND FORMAT		
Headings		Content
Issues and Enhancements	Issue Description	<ul style="list-style-type: none"> Describe the issue or problem background, importance, and consequences or task to be done to support the acquisition
	Objectives	<ul style="list-style-type: none"> Identify Human Factors Program objectives Provide performance measures and criteria in terms of time and accuracy to perform tasks to evaluate resolution of issue When human performance thresholds are known, identify tasks for the developer to be done early enough in the acquisition to influence requirements and system engineering Identify the actions to be taken to resolve each issue Show the current status of each issue
	Actions	<ul style="list-style-type: none"> Identify actions to be taken to resolve issues Show current status of each action
Activities	Activity Description	<ul style="list-style-type: none"> Identify any tasks, studies, or analyses that must be performed to resolve the issues (e.g., Human Factors Program Plan per MIL-HDBK-46855, Functional Analysis to support equipment vs. people allocation of functions, Task Analysis to produce a specific operator and maintainer task list)
	Activity Schedule	<ul style="list-style-type: none"> By acquisition phase, describe the human factors tasks in terms of who, what, when, and how (resources) Identify feeds to and dependencies on ILS, training, and test and evaluation programs
Strategy	Goals and Requirements	<ul style="list-style-type: none"> Strategy is derived from the major concerns, issues, schedule, tasks, guidance, constraints, objectives, and approach for the Human Factors Program Answer the question, "What objectives does the government wish to achieve?" Answer the question, "How will the government accomplish these objectives?"
	Approach	<ul style="list-style-type: none"> Define responsibility for the Human Factors Program Set out the extent of contractor support required Define how human factors resources will be organized and managed to support the system acquisition
	References	<ul style="list-style-type: none"> Identify relevant references needed for a full understanding of the Human Factors Program
Review	Review	<ul style="list-style-type: none"> Identify administrative handling procedures Identify update schedule and procedure Identify review procedures

2.2 Human Engineering Analyses. Analyses are conducted in support of various program activities during each of the system acquisition phases. These analyses are developed from a baseline mission scenario and include application of human engineering techniques as follows:

2.2.1 Defining and allocating system functions. The functions that must be performed by the system in achieving its objective(s) within specified mission environments are analyzed. Human engineering principles and criteria are applied to specify human-system performance requirements for system operation, maintenance and control functions and to allocate system functions to: (1) automated operation and maintenance, (2) manual operation and maintenance, or (3) some combination thereof. Function allocation is an iterative process achieving the level of detail appropriate for the level of system definition.

2.2.1.1 Information flow and processing analysis. Analyses are performed to determine basic information flow and processing required to accomplish the system objective and include decisions and operations without reference to any specific hardware, software, or facilities implementation or level of human involvement.

2.2.1.2 Estimates of potential operator and maintainer processing capabilities. Plausible human roles (e.g., operator, maintainer, programmer, decision-maker, communicator, monitor) in the system are identified. Estimates of processing capability in terms of workload, accuracy, rate, and time delay are prepared for each potential operator and maintainer information processing function. Comparable estimates of equipment capability also are made. These estimates are used initially in determining allocation of functions and are later refined for use in definition of operator and maintainer information requirements and of control, display, and communication requirements. In addition, estimates are made of the effects on these capabilities likely to result from implementation or non-implementation of human engineering design recommendations.

2.2.1.3 Allocation of functions. From projected operator and maintainer performance data, estimated cost data, and known constraints, analyses and trade-off studies are conducted to determine which system functions are machine-implemented or software-controlled and which are reserved for the human operator or maintainer. Allocation of functions considers the risks of making an incorrect decision for each alternative being evaluated so that designs may be simplified or enhanced to prevent or minimize situations where human decisions are made under conditions of uncertainty, time stress, or workload stress. The possibility of influencing human or equipment capabilities through personnel selection and training as well as through equipment and procedure design is considered, and the costs of such action are considered in trade-off and cost-benefit studies.

2.2.2 Equipment selection. Human engineering principles and criteria are applied along with other design requirements to identify and select the particular equipment to be operated, maintained, or controlled by personnel. The selected design configuration reflects human engineering inputs expressed in "best estimate" terms to satisfy the functional and technical design requirements and to ensure that the equipment will meet the applicable human engineering criteria.

2.2.3 Analysis of tasks and workload. Human engineering principles and criteria are applied to analyses of tasks and workload. These analyses are also provided as basic information for developing preliminary manning levels; equipment procedures; skill, training, and communication requirements; and as logistic support analysis inputs, as applicable.

2.2.3.1 Analysis of tasks. An analysis of tasks is conducted and provide a basis for making design conceptual decisions, e.g., determining, to the extent practicable, before hardware fabrication, whether system performance and maintenance requirements can be met by combinations of anticipated equipment, software, and personnel and ensuring that human performance requirements do not exceed human capabilities. Time requirements for tasks are evaluated with respect to task duration vs. time availability, task sequencing, and task simultaneity. Task requirements are evaluated, as applicable, with respect to accuracy, precision, completeness, and the effects of task feedback, error tolerance, and error recovery on performance.

2.2.3.2 Task inventory. A task inventory is prepared to list all of the tasks that operator, maintainer and support personnel are to perform with regard to the system hardware, equipment, or facility under development. The task inventory includes a listing of the tasks required to perform operator, maintainer, and support functions and a description of each task in behavioral terms. The tasks are organized or grouped according to logical criteria such as purpose and function.

2.2.3.3 Task analysis. Tasks judged to be of greater importance according to the established criteria are subjected to a task analysis. A set of data relevant to each task (critical or other) is collected and analyzed. For each critical task, the minimum data collected and analyzed are:

- Equipment acted upon,
- Consequence of the action,
- Feedback information resulting from the action,
- Criterion of task accomplishment,
- An estimate of probability of error,
- An estimate of the time to successful performance,
- A time and error rate associated with each critical task and how it relates to the time and error rate and performance time for the overall system

2.2.3.4 Analysis of critical tasks. A further detailed analysis of critical tasks identifies the:

- Information required by operator and maintainer, including cues for task initiation;
- Information available to operator and maintainer;
- User evaluation process;
- Decision reached after user evaluation;
- Action taken;
- Body movements required by action taken;
- Workspace envelope required by action taken;
- Workspace available;

- Location and condition of the work environment;
- Frequency and tolerances of action;
- Time base;
- Feedback informing operator and maintainer of the adequacy of actions taken;
- Tools and equipment required;
- Number of personnel required, their specialties, and experience;
- Job aids, training, or references required;
- Communications required, including type of communication;
- Special hazards involved;
- Operator interaction where more than one crewmember is involved;
- Performance limits of personnel; and
- Operational limits of hardware and software.

The analysis is performed for all affected missions and phases including degraded modes of operation. Each critical task is analyzed to a level sufficient to identify operator and maintainer problem areas that can adversely affect mission accomplishment and to evaluate proposed corrective action.

2.2.3.5 Workload analysis. Operator (individual and crew) and maintainer (individual and team) workload analyses are performed and compared with performance criteria. To avoid overloading or underloading, the degree to which demands of any task or group of tasks tax the attention, capacities, and capabilities of system personnel (individually and as a coordinated crew) and thus affect performance is evaluated. Sensory, cognitive, and physiological limitations are considered, as applicable. The workload analyses define operational sequences and task times. Preliminary workload estimates correlate mission segments with crew tasks for each task component (e.g., visual, auditory, motor, cognitive) related to time, workload, and mental effort. A collective workload estimate for each crewmember is defined in a fashion permitting crew workload to be related to mission segment(s).

2.2.3.6 Corrective action. Human-system interface design incompatibilities and excessive skill or physical requirements, identified by analysis of tasks, analysis of critical tasks, or workload analysis, are corrected by changing design or restructuring tasks to preclude degraded human performance resulting from task or workload factors.

2.2.3.7 Timelines and availability. Analyses of tasks are modified as required during subsequent program developments to remain current with the design effort and the data and results are made available to all appropriate program personnel.

2.2.4 Preliminary system and subsystem design. Human engineering principles and criteria are applied to system and subsystem designs represented by design criteria documents, specifications, drawings, and data. Data include: functional flow diagrams, system and subsystem schematic block diagrams, interface control drawings, overall layout drawings and related applicable drawings provided in compliance with contract data requirements. The preliminary system and subsystem configuration and arrangement should satisfy human-system performance requirements and comply with applicable human factors criteria.

2.3 Human Engineering in Detail Design. In detail design, the human engineering inputs, made in complying with the analysis guidelines, as well as other appropriate human engineering inputs, are converted into detail engineering design features. Design of the equipment should satisfy human-system performance requirements and meet the applicable human engineering criteria. Human engineering considerations for testing the system or equipment include such factors as verifying proper operation, defining need for maintenance, and allocating adequate space for test personnel to perform their tasks. Human engineering provisions in the equipment are evaluated for adequacy during design reviews. Personnel assigned human engineering responsibilities by the contractor should participate in design reviews and engineering change proposal reviews of equipment involving the human-system interface.

Representative human engineering activities in acquisition and systems engineering processes include participation in:

- Preparing operationally realistic mission profiles and mission scenarios
- Preparing functional flow block diagrams for the system
- Performing functional analyses of each flow block and defining operational and support equipment and facilities requirements
- Preparing system and subsystem schematic block diagrams
- Studying detailed functions, environment and technical design requirements to allocate tasks to personnel, equipment, software, or some combination thereof
- Preparing operation and maintenance timeline analyses to determine system reaction time
- Preparing and analyzing operations and maintenance workload and task data to influence equipment and procedure design and to determine equipment quantities, quantitative and qualitative personnel requirements, and system downtime for scheduled and unscheduled maintenance
- Identifying training implications
- Conducting trade studies
- Participating in preparation of specifications for the system
- Participating in design reviews, demonstrations, and test/evaluation activities
- Influencing design of software and hardware user interfaces and applicable processes and procedures

2.3.1 Experiments, tests, and studies. The government and contractor conduct experiments, tests (including dynamic simulation), and studies required to resolve human engineering problems specific to the system. Experiments, tests, and studies are performed with actual users in the actual or realistic simulation of the user environment in order to validate design goals and system performance. These experiments, tests, and studies are accomplished in a timely manner so that their results may be incorporated in equipment design and, if necessary, used to revise initial function allocations. Any significant human engineering deficiency, deemed to be resolvable only by major experiment, test, or study effort, should include the estimated effect on the system if the problem is not resolved. To ensure that experiments, tests, and studies do not duplicate current or previously conducted efforts that may be germane to resolving human engineering problems, the applicability and utility of the existing human engineering and other relevant databases (e.g.,

general literature, research reports, study reports) are determined before initiating major efforts.

2.3.1.1 Prototypes and computer models. As required, three-dimensional computer models, rapid prototyping, and computer-aided design/computer-aided manufacturing (CAD/CAM) techniques are used to develop design of equipment where human performance will be a determinant of operational performance and maintenance effectiveness. Computer models are able to provide a suitable range of body sizes, clothing, and postures for evaluation of proposed designs and design changes in terms of compatibility with fit and access; finger, hand, arm, and other access and reach; visual field; and strength. Computer models should not be used for compliance testing of human performance and human engineering design. When used for predictive purposes, such models should produce accurate and empirically repeatable, valid outputs. Computer models, rapid prototyping, and CAD/CAM are to be accessible and should, as applicable, be available during design reviews.

2.3.1.2 Three-dimensional mockups. At the earliest practical point in the development program and well before fabrication of system prototypes, full-scale three-dimensional mockups of equipment involving critical human performance are constructed. The mockups are constructed sufficiently early to ensure that results of human engineering evaluations can influence design. The mockups are no more elaborate or expensive than is essential to represent those aspects of the human-system interface to be evaluated. These mockups provide a basis for resolving operational and maintenance access, workspace, and related human engineering problems, and incorporating solutions into system design.

2.3.1.3 Scale models. Scale models may be used to supplement three-dimensional computer models, rapid prototype, CAD/CAM, or mockup techniques.

2.3.1.4 Dynamic simulation. Engineering simulators (full-scale physical models which simulate functions) may be used when static, three-dimensional mockups are inadequate for assessing human performance in the design of complex systems. These dynamic mockups may be used to: (1) evaluate operator procedures and equipment-operator interfaces, and identify any potentially unsafe procedures and unacceptable workload demands; (2) evaluate the non-mechanical aspects of a design, such as control dynamics, communications, information, electronic displays, and display formats; and (3) emulate the user-system performance to derive estimates of performance for alternate design configurations and cost-effectiveness evaluations of variable staffing, personnel characteristics, and training parameters. While the simulation equipment is intended for use as a design tool, its design should consider the opportunity to transition technology to subsequent training simulators.

2.3.2 Engineering drawings. Human engineering principles and criteria are reflected by the engineering drawings and CAD representations to ensure that the final product can be effectively, efficiently, reliably, and safely used and maintained. The following drawings are included: system layout, panel layout, control, communication system, individual equipment design, and other drawings depicting equipment important to system operation and maintenance by human operators. Design, reflected by such drawings, should comply with applicable human engineering criteria. Personnel assigned human engineering responsibility should review all layouts and

drawings having potential impact on human performance or interface and should identify for corrective action those designs which may induce human error or be unsafe.

2.3.3 Work environment, crew stations, and facilities design. Human engineering principles and criteria are applied to detail design of work environments, crew stations, and facilities to be used by system personnel. Drawings, specifications, and other documentation of work environments, crew stations, and facilities should reflect incorporation of human engineering guidelines and compliance with applicable human engineering criteria. Design of work environments, crew stations, and facilities that affect human performance, under normal, unusual, and emergency conditions should consider at least the following (where applicable):

- Weather and climate aspects;
- Acoustic noise;
- Adequate space for personnel, their movement, tools, job aids, and equipment;
- Adequate physical, visual, and auditory interface between personnel and their equipment including eye positions in relation to display surfaces, controls, and external visual areas;
- Safe and efficient walkways, stairways, platforms, and inclines;
- Effects of clothing and any personal equipment;
- Equipment handling provisions;
- Safe and error-proof equipment installations;
- Protection from thermal, mechanical, electrical, electromagnetic and other hazards;
- Optimum illumination commensurate with anticipated visual tasks;
- Safety protective controls and equipment; and
- Adequate space, clearance, and layout for normal access, ingress, and egress.

2.3.4 Human engineering in performance and design specifications. The provisions of performance, design, and procurement specifications, prepared by the government or contractor, should invoke applicable human engineering human engineering criteria.

2.3.5 Procedure development. Based upon the human performance functions and tasks identified by human engineering analyses, the government and contractor should apply human engineering principles and criteria to the development of procedures for operating, maintaining, or otherwise using the system equipment. This effort is accomplished to ensure that the human functions and tasks identified through human engineering analysis are organized and sequenced for efficiency, safety, and reliability to provide inputs to the logistic support analysis where required, and to assure that the results of this effort are reflected in the development of operational, training, and technical publications.

2.3.6 Software development. The contractor applies human engineering principles to software design in those systems where software determines part of the human interface. Software that affects controls and displays are evaluated for its impact on the human-system performance. Automated system functions requiring human monitoring or intervention are considered as part of the human-system interface. Multifunction controls and displays that vary in function depending on system software also are considered to be part of the human-system interface.

2.3.7 Manuals. Human engineering is applied to the development of maintenance and training manuals (electronic or hard-copy) to ensure thoroughness, technical accuracy, suitable format of information presentation, appropriate reading level, technical sophistication required, and clarity, including quality of illustrations.

2.4 Human Engineering in Test and Evaluation. The government and contractor establish and conduct a test and evaluation program to: (1) demonstrate conformance of system, equipment, and facility design to applicable human engineering design criteria and guidelines; (2) confirm compliance with system performance requirements where personnel performance is a system performance determinant; (3) secure quantitative measures of system performance which are a function of the human interaction with equipment; and (4) determine whether undesirable design or procedural features have been introduced. Maximum use is to be made of the data collected from experiments, tests, and studies. The fact that these functions may occur at various stages in system, subsystem, or equipment development should not preclude final human engineering verification of the complete system. Both operator and maintenance tasks are performed as described in approved test plans during the final system test.

2.4.1 Test Planning. Human engineering testing is incorporated into the system test and evaluation program and is integrated into engineering design and development tests, contractor demonstrations, operational tests, acceptance tests, and other development tests. Compliance with human performance requirements is tested as early as possible. Human engineering findings from design reviews, prototype reviews, mockup inspections, demonstrations, and other early engineering tests are used in planning and conducting later tests. Human engineering test planning is directed toward verifying that the system can be operated, maintained, supported, and controlled by user personnel in its intended operational environment. Human engineering test planning should also consider data needed or to be provided by operational test and evaluation. Test planning should include methods of testing (e.g., use of checklists, data sheets, test participant descriptors, questionnaires, operating procedures, and test procedures), schedules, quantitative measures, test criteria, and reporting processes.

2.4.2 Test Implementation. The human engineering test and evaluation plan is implemented to include the following:

- Performance of mission or work, or a simulation thereof if actual performance is not possible;
- Critical tasks;
- A representative sample of non-critical, scheduled and unscheduled maintenance tasks that do not duplicate the tasks selected for the maintainability demonstration;
- Proposed job aids, new equipment training programs, training equipment, and special support equipment;
- Use of personnel who are representative of the range of the intended user populations in terms of skills, size, and experience;
- Collection of task performance data in actual operational environments, or in simulated environments if such collection is not possible in the actual operating environment;
- Identification of discrepancies between required and obtained task performance; and
- Criteria for acceptable performance of the test.

2.4.3 Failure and error analysis. All failures occurring during test and evaluation are subjected to a human engineering review to differentiate between failures: (1) of equipment alone; (2) resulting from human-system incongruities and lack of error tolerance; and (3) due to human error. Human errors occurring in the performance of critical tasks during test and evaluation are analyzed to determine the reason for their occurrence. The government or contractor should identify those design characteristics or procedures that may contribute substantially to human error and should propose corrective action.

2.4.4 In-Service Management and Service Life Extension Follow-up Activities. Changes affecting human performance during the production, deployment, operations and support of a system can, like product improvement actions, involve concept definition, validation, or engineering development human engineering tasks. Therefore, the human engineering should be an integral part of activities during later phases of the program.

2.5 Human Engineering Program Management and Coordination. Human factors is a multidisciplinary effort to generate, compile, and apply information about human capabilities and limitations. Human factors professionals assist in applying human factors information related to human resources management, training, safety, medical, and human engineering. Management and coordination of the human factors program is necessary to ensure that:

- system requirements are achieved by appropriate use of the human component;
- through proper design of equipment, software, facilities, and environment, the personnel and system can meet system performance goals;
- design features will not constitute a hazard to personnel;
- trade-off points between automated vs. manual operation have been chosen for peak system efficiency within appropriate cost limits;
- human engineering applications are technically adequate;
- the equipment is designed to facilitate required maintenance;
- procedures for operating and maintaining equipment are efficient, reliable, and safe;
- potential error-inducing equipment design features are minimized; and
- the layout of the facilities and the arrangement of equipment affords efficient communication and use.

2.5.1 The human factors process can be summarized by four management actions listed below. These four human factors functions are integrated within the acquisition process as shown in Table 3.

- Manage the human factors program
- Establish human factors requirements
- Conduct human factors system integration
- Conduct human factors test and evaluation

2.5.2 Technical Reviews. Human engineering should also participate in the major technical reviews, as applicable to the acquisition phases. Human engineering should also participate in subsystem reviews, including, where applicable, software specification, test readiness, and functional reviews (e.g., support, training, systems engineering, test, and manufacturing). Major technical reviews include:

- Alternative system reviews,
- System requirements reviews,
- System functional reviews,
- Preliminary design reviews,
- Critical design reviews, and
- System verification reviews.

2.5.3 Data Availability. All data, such as plans, analyses, design review results, drawings, checklists, design and test notes, and other supporting background documents reflecting human engineering actions and decision rationale, are maintained and made available as appropriate to assist in the monitor, control, or coordination of the program.

2.5.4 Data Traceability. Documentation should provide traceability from initially identifying human performance requirements during planning, analysis, and system engineering, through implementing such requirements during design and development, to verifying that these requirements have been met during test and evaluation of approved equipment, software, facilities, and procedures.

2.5.5 Risk management. Risk management procedures are planned and implemented for the entire lifecycle of the system. Human performance and human engineering design criteria issues that involve potential technical, cost, or schedule risks are identified, analyzed, and prioritized as early as possible to establish provisions for eliminating or reducing the associated risks to acceptable levels. Such provisions are implemented and monitored during the human engineering program. Risk management should:

- Identify potential cost schedule, design, and performance risks that result from design aspects of human system integration;
- Quantify such risks and their impacts on cost, schedule, and performance;

- Evaluate and define sensitivity of risks interrelated with human engineering design;
- Identify alternative solutions to moderate and high risk human engineering problems and define their risks;
- Take actions to avoid, minimize, control, or accept each human engineering risk; and
- Ensure that human performance and design risk is an element of the specification requirements.

**TABLE 3: HUMAN FACTORS IN THE FAA LIFECYCLE ACQUISITION MANAGEMENT PROCESS
(COTS, NDI & Developmental Programs)**

PHASE ACTION	MISSION ANALYSIS	INVESTMENT ANALYSIS	SOLUTION IMPLEMENTATION	IN-SERVICE MANAGEMENT (INCLUDING SERVICE LIFE EXTENSION)
MANAGE THE HUMAN FACTORS PROGRAM	<ul style="list-style-type: none"> • Identify Human Performance Deficiencies • Identify Opportunities to Improve Human Performance • Initiate Human Factors Goals and Objectives 	<ul style="list-style-type: none"> • Designate Human Factors Coordinator • Establish Human Factors Working Group • Develop the Human Factors Program • Draft Human Factors Considerations for Input to the IPP 	<ul style="list-style-type: none"> • Refine the Human Factors Program • Prepare the Human Factors Portion of the IPP 	<ul style="list-style-type: none"> • Refine the Human Factors Program • Revise the Human Factors Portion of IPP
ESTABLISH HUMAN FACTORS REQUIREMENTS	<ul style="list-style-type: none"> • Identify Human Factors and Human Resource Constraints 	<ul style="list-style-type: none"> • Establish Human Factors Requirements in Acquisition Documents • Formulate Draft Human Factors Requirements for a System Specification • Generate Initial Human Factors Requirements for a SOW 	<ul style="list-style-type: none"> • Revise Human Factors Requirements in the System Specification • Refine Human Factors Requirements in the SOW • Specify Human Factors Requirements for Source Selection 	<ul style="list-style-type: none"> • Update Human Factors Requirements for System Modifications and Upgrades
CONDUCT HUMAN FACTORS SYSTEM INTEGRATION	<ul style="list-style-type: none"> • Identify Potential Human Factors Analyses and Trade-offs 	<ul style="list-style-type: none"> • Provide Human Factors Inputs to Acquisition Documents • Initiate Human Factors Tasks and Activities • Coordinate Human Factors Tasks and Activities with ILS 	<ul style="list-style-type: none"> • Revise Human Factors Inputs to Acquisition Documents • Continue Human Factors Tasks and Activities • Coordinate Results of Human Factors and ILS Analyses 	<ul style="list-style-type: none"> • Monitor Results of Human Factors and ILS Activities
CONDUCT HUMAN FACTORS TEST AND EVALUATION		<ul style="list-style-type: none"> • Draft/Revise Human Factors Inputs for T&E Plans • Conduct Front-end Analysis 	<ul style="list-style-type: none"> • Revise Human Factors Inputs to T&E Plans • Participate in Developmental and Operational Testing 	<ul style="list-style-type: none"> • Monitor Human Factors Test and Evaluation Activities • Conduct Post-Deployment Assessments